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PROVINCE OF QUEBEC, CANADA

Department of Colonization, Mines and Fisheries

BUREAU OF MINES

Hon. J. E. PERRAULT, Minister - S. DUFAULT, Deputy-Minister

THÉO. C. DENIS, Superintendent of Mines

Engineering

REPORT ON

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

DURING THE YEAR 1919

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PROVINCE OF QUEBEC, CANADA

Department of Colonization, Mines and Fisheries

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Honourable J. E. PERRAULT, Minister - S. DUFAULT, Deputy-Minister

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Province of Quebec

DEPARTMENT OF COLONIZATION, MINES AND FISHERIES

To the Honourable J. E. Perrault,

Minister of Colonization, Mines and Fisheries,
Quebec.

Sir,—

I have the honour to transmit to you the Report on the "Mining Operations in the Province of Quebec" for the year ending December 31st, 1919. This publication is the Annual Report of the technical branch of the Bureau of Mines.

I remain, Sir,

Your obedient servant,

S. DUFAULT,
Deputy Minister.

Quebec, May 3rd, 1920.

Province of Quebec

DEPARTMENT OF COLONIZATION, MINES AND FISHERIES

BUREAU OF MINES

Mr. S. Dufault,
Deputy-Minister of Colonization,
Mines and Fisheries, Quebec.

Dear Sir,—

I beg to transmit to you the Annual Report of the Bureau of Mines of the Department, for the year ending December 31st, 1919.

This report, entitled "Mining Operations in the Province of Quebec during 1919," gives the statistics of production of the mines and quarries; of labour employed in the mining industry in the Province; of mining accidents which occurred; a synopsis of the mining operations and development during the year, and the reports of the geological field-work done in 1919.

As in the past years, the report on "Mining Operations in the Province of Quebec in 1919" was preceded, on February 27th, by a statistical statement of the mineral production, giving provisional figures subject to revision. The present report gives the revised statistical figures, and the tables given in this volume supersede those of the preliminary statement.

Yours very obediently,

THEO. C. DENIS,
Superintendent of Mines.

Quebec, May 3rd, 1920.

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NOTE

In the statistical tables and in the review of the mining industry of the Province during the year, the term "production" is synonymous with "quantity sold or shipped," and does not necessarily represent "output." The ore and other mineral products remaining as "stock on hand" at the end of the year are not included in the production figures.

The ton used throughout is that of 2,000 lb., except when specially mentioned.

The year referred to is the calendar year, ending December 31st unless specially stated.

We endeavour to give values of the mineral products, raw or prepared, as estimated at the point of shipment or at the pit-mouth; this, however, is sometimes difficult to obtain.

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

DURING THE YEAR 1919

STATISTICAL REVIEW

The total value of the production of the mines, quarries, brick yards, sand-pits of the Province of Quebec, during the year ending December 31st, 1919, reached $20,813,670. In 1918, this value was $18,707,762. We therefore record an increase of $2,105,908 or 11.3% for 1919, as compared with the previous year. These are the highest figures of annual production ever recorded for the Province of Quebec. The result is particularly gratifying if we consider that, according to the preliminary report issued by the Federal Department of Mines, the total mineral production of Canada for 1919 shows a decrease of 38¼ million dollars, or 18% as compared with 1918. Hence, the past year has been prosperous for our mineral industry. The value of its output indicates that the industry has not suffered during the period of transition and readjustment from war conditions to a more normal peace regime. It was feared that during the year following the termination of the world war, after more than fifty months of incessant struggle, industrial disarray would ensue and have an effect on our mineral output. While this was so for the greater part of the world, and for most of the provinces of the Dominion, Quebec felt no adverse effects from the change of conditions. This is due to the fact that the majority of our mineral products has so far consisted of substances used in peace industries, such as, asbestos, mica, building materials. The Province, produces also several of the so-called "war-minerals", such as pyrites, molybdenite, magnesite, chromite, the mining of which received a very strong impetus

during the hostilities, and the armistice reacted strongly on these materials. But the decrease recorded for such items were more than compensated by the increases fared by the other products.

The high proportional increases in value, which each year has shown over the previous one since 1914, have in a measure, to be attributed to higher prices rather than to increases in tonnage for the various items. The quantities have not grown at the same rate, and as an extreme example of this state of things, we may quote our main product, asbestos, which in 1919, figures for an increase in value of 279%, as compared with 1914, while the tonnage has only increased 33% in the same period. The same comparison for cement shows an increase of 33.6% in value and a decrease of 20.5% in quantity; brick shows an increase in value of 7.8%, and a decrease in quantity of 31.2%.

The difficult period of transition from war conditions to a state of peace has been marked during the year following the armistice of November, 1918, by a world-wide industrial and social unrest. This unsettled and restless state of the peoples has manifested itself by disturbances, such as strikes, riots and violences which have brought confusion over the greater part of the world, and there are very few countries which have not materially suffered from such derangements.

It is a matter of congratulation to note that, on the whole, the Quebec mineral industry has felt the adverse effects of after-war conditions, less than most other parts of North America. Our province has been comparatively free from the social and industrial disquiet which is so marked throughout most of Canada. There have not been labour troubles and strikes on a such scale that they paralyzed for months the production of certain minerals as in several of the other provinces. "It is not easy to determine why the province is more free of troubles during the critical period of readjustment to pre-war conditions, but one of the contributing reasons is certainly the fact that the people of Quebec appear to have confidence in the judgment and the advice of the "directing" classes, and they seem to remain indifferent to the insinuative, and often plausible, urgings of theorists who have panaceas to bring about the advent of utopian conditions, and of the millenium." (1)

(1) Denis, *Canadian Mining Journal*, Jan. 7th, 1920.

The cost of labour, of course, has increased in keeping with the cost of living; but the demands of the miners have not been such that they could not be amicably and satisfactorily settled between employers and employees, without prejudice to the industries.

The progress of mining in the Province of Quebec, in the last twenty years, cannot be more graphically illustrated than by a table of the annual value of the products of the mineral industry.

TABLE OF VALUE OF ANNUAL MINERAL PRODUCTION OF QUEBEC FROM 1900 TO 1919

YEAR	VALUE	YEAR	VALUE
1900	$ 2,546,076	1910	$ 7,323,281
1901	2,997,731	1911	8,679,786
1902	2,985,463	1912	11,187,110
1903	2,772,762	1913	13,119,811
1904	3,023,568	1914	11,732,783
1905	3,750,300	1915	11,465,873
1906	5,019,932	1916	13,287,024
1907	5,391,368	1917	16,189,179
1908	5,458,998	1918	18,707,762
1909	5,552,062	1919	20,813,670

TABLE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC DURING 1919.

Sunstances	No. of workmen	Wages	Quantities	Value in 1919	Value in 1918
		$		$	$
Asbestos, tons	4,031	3,997,154	135,861	10,932,289	9,019,899
Asbestic, tons	.....	.....	23,827	63,011	34,046
Chromite, tons	183	165,175	8,184	223,331	770,955
Copper and Sulphur ore, tons	239	224,549	53,965	447,623	1,319,690
Feldspar and Kaolin tons	39	31,751	1,684	25,409	24,103
Gold, oz	43	15,920	1,446	29,420	32,615
Graphite, tons	24	7,196	20	400	33,274
Iron and Titaniferous iron ores, ton.	.....	.....	.....	.....	33,726
Magnesite, tons	181	95,263	9,940	283,719	1,016,764
Mica, lb	252	92,063	3,853,265	224,988	202,149
Mineral water, gals.	18	4,260	30,519	12,608	6,111
Mineral paints (iron oxide, ochre), tons	83	69,591	11,937	111,645	112,440
Molybdenite, lb	195	60,164	83,002	69,203	383,252
Peat, tons	14	3,832	486	4,811	.....
Phosphate, ton	.....	.....	20	300	1,200
Quartz & Silica, tons	91	25,800	15,055	50,161	61,669
Silver, oz	.....	.....	127,223	141,373	139,788
Zinc and Lead ore, tons	170	160,100	5,318	103,138	175,094
Building Materials					
Brick, M	746	499,949	94,312	1,179,624	595,719
Cement, bbls	526	647,227	2,259,152	4,337,572	3,003,534
Granite	229	186,779	.....	334,692	224,861
Lime, bush	223	178,029	2,124,898	521,031	438,673
Limestone, tons	1,127	535,988	708,172	916,776	666,046
Marble, c. ft	118	114,593	19,201	192,489	.....
Sand, building, tons.	189	54,670	486,877	180,987	87,308
Sandstone, tons	16	5,190	720	3,850	.....
Slate, sq	24	17,004	1,632	10,853	5,124
Tile, drain and sewer pipe, pottery, etc.	169	149,372	.....	412,367	319,722
	8,930	7,341,619	.....	20,813,670	18,707,762

GEOLOGICAL FIELD WORK

The geological field work undertaken by the Quebec Bureau of Mines during the summer of 1919 consisted in a detailed examination of the gold deposits of the Upper Harricana river, and of the molybdenite occurrences of La Corne township, in the same region, by Mr. A. Mailhiot, professor of geology at the Ecole Polytechnique, University of Montreal; an investigation by T, C. Denis, of an alleged discovery of a new gold field in the unsurveyed portion of Gaboury township, to the south of Lake des Quinze and a short examination of a development of serpentine rock near Lake Mckenzie in the same township. The results of this work are given in Mr. Mailhiot's full reports, further on in this volume, and in notes by Mr. Denis, under the respective headings of gold and asbestos in 1919.

The importance of geological field-work and exploration by Government Mines Departments needs not be emphasized. Its value is well recognized and appreciated by the interested public. It is a matter of regret that, owing to dearth and scarcity of trained competent geologists, comparatively little of it is done when we consider the area of the practically unknown parts of the Province of Quebec. The portion of the Province which extends north of the Transcontinental railway and north of the Saguenay river, is at present only accessible by canoe in summer, and by dog teams in winter, and such long trips are not within the means of the average prospector. Therefore, both Federal and Provincial authorities are justified in endeavouring to render all aid possible to prospecting operations, by doing preliminary exploration work and publishing geological maps and reports which guide the prospector in his search for mineral deposits.

In connection with the question of transportation for such exploration work, it is possible that the airplane may be called to render great services in a more or less near future, and it is interesting to quote, in part, an editorial of the Engineering and Mining Journal, (1) of New York, entitled "Airplane for Canadian Pros-

(1) *Engineering and Mining Journal*, New York, March 13th, 1920.

pecting", which applies particularly happily, to the physiographic conditions of the Pre-Cambrian plateau which extends north from the Ottawa and St. Lawrence rivers to Hudson strait.

"The evident and immediate practicability of this help to "prospecting and development seems to us beyond question; and "we predict that the airplane will prove of great utility in bringing "to knowledge mineral deposits of the waste places of the earth, "and that soon.

"The main problem for an airplane is landing places; and "arctic Canada offers ideal conditions for this in her thousands of "lakes, hollows gouged out by the great continental glacier of long "ago, and now covering a good part of the surface. It is on account "of this that canoe travel is possible through the north. An "airplane of the hydroplane variety could find a landing place in "a small lake or quiet bay of a large lake almost everywhere in the "region under discussion; and could ride safely till ready to start. "Any minor accident which would require temporary landing "would not be serious.

"An airplane which could be hired for the purpose, with "skilled aviator and pilot, for a relatively small amount, could "transport in one trip say three men and supplies for a season to "a given point. The trip could be made early in August, so that "the explorers could investigate through the late summer and fall; "and the airplane could at an appointed time call for them and "bring them back to civilization before the severe cold set in. If "the airplane should circle around in a radius of fifty miles from "the camp and a few photos be taken, a rough map could be ob- "tained from which the prospectors could plan their excursions.

"We need not dwell on the details of such a plan—the further "possibilities, or the sane precautions which will occur to any old "woodsman or son of the North. We would not recommend such "a trip to greenhorns; but for the experienced traveller of sporting "blood, surely this would, and will, appeal.

"The charm of exploring, charting, treasure-hunting, and "fishing, in a new country, would be combined and the trip could "be robbed of the usual tedium and hardship."

MINING VENTURES AND THE PUBLIC

Many warnings have been issued through the annual reports of the Quebec Bureau of Mines, guarding the public against the insidious literature and glowing statements of agents, offering mining shares and beautifully engraved certificates in ventures which have never had a chance of success, and we here repeat that the Quebec Bureau of Mines is entirely at the disposal of the public for technical information regarding the mines and mineral resources of the Province of Quebec. An enquiry on such subjects, addressed to the Department of Colonization, Mines and Fisheries, Quebec, always brings to the writer information from which he usually can judge of the merits of mining ventures in the Province, and this will enable him to go into it with a better knowledge of the facts.

We think it opportune to here repeat these warnings, for with the resumption of more normal trade and industrial conditions, will probably come the re-appearance of the professional promoter of more or less avowable enterprises, issuing beautifully engraved stock certificates and brilliant prospectuses.

Although such activities are not limited to mining, it must be owned that the lure of returns of one thousand to one on the money invested in mining ventures, as usually inferred by the promoting literature, often attracts and entraps men otherwise sane and of keen business acumen. The last three years have been very prosperous and a great deal of savings has been accumulated, both in rural and urban communities, as demonstrated by the success of the various war-loans issued by the Government. This may prove an incentive to shady and questionable promoters to launch new efforts to make victims, especially in rural communities and among urban people of small means.

Therefore, before putting their hard-earned savings into mining or other ventures, of which they personally know little or nothing, the investors should enquire from reliable and disinterested sources as to the value and chances of success of such enterprises. The statements and promises of agents, whose sole interest is to

sell shares, should not be taken without thoroughly investigating them.

The investing public should discriminate between "mines" and "prospects". Some producing mines, or mines well developed, constitute as safe an investment as any other commercial and industrial enterprise, but these rarely yield more than a fair return. On the other hand, "prospecting" and "developing", be it for ores, for natural gas, for oil, are naturally hazardous ventures. When successful, the returns from such investments are large, but failures are infinitely more numerous than successes. Such investments are not for the small savings, for it should always be remembered that the risk is proportionate to the returns. If the investor expects large returns he has to take great risks of losses. And before buying shares in companies searching for, or developing, deposits of gold, lead, zinc, or other minerals, or carrying on boring operations for gas and oil, the public should investigate the statements made by the peddlers of stock certificates, enquire from reliable sources as to the possibilities of the enterprises, so as to be able to discriminate between (1) "safe mining investments", (2) "legitimate and reasonable mining speculation," and (3) "mining frauds". In the first the returns are not high but are reasonably sure; in the second, the money contributed by the buyers of shares is really expended in intelligent search and development on the mineral deposits, which may or may not answer the hopes which were founded on them; and the third class comprises the ventures of shady adventurers who spend the money obtained from the sale of shares on full page advertisements, in printing alluring and tempting prospectuses for the purposes of obtaining more money, of which the smallest possible fraction is spent in actual work, usually on hopeless mining claims.

NOTICES AND REPORTS BY MINE OPERATORS TO THE DEPARTMENT

The Bureau of Mines, among its functions, collects and compiles the statistics of the mineral production of the Province, and has charge of the inspection of working mines and quarries, from

the standpoint of the safety of the workmen. The Department, therefore, has to keep in close touch with the operators of mines and quarries, and the latter are under obligation, by various provisions of the Quebec Mining Law, to give certain notices and make reports to the Department. As some may not be sufficiently familiar with these statutory regulations, we reproduce here various articles of the Law dealing with these rules:—

Article 2163.—Every owner of mining rights, whether he mines himself or by others, and every person working mines shall, during the first ten days of January in each year, furnish a sworn statement of his operations of the past year, mentioning the quantity of mineral extracted, its value at the mine, the quantity and value of the marketable product, and the number of workmen employed, as well as a list of the names of persons killed in working the mines. R. S. P. Q. 1498; 1 Ed. VII, c. 13, s. 5; 9 Ed. VII, c. 27, s. 12.

Article 1292. Every person who commences to operate a mine or quarry, or who, after a suspension of six months, resumes operations already begun by himself or by others, is bound, under penalty of a fine of no more than twenty-five dollars, and costs, and, in default of payment, to imprisonment for not more than one month, to give to the Minister a notice in writing setting forth:

1. The name and address of the person carrying on the operations;

2. The locality and the description of the land on which such operations are carried on;

3. The nature of the ore or mineral which is the object of the operations. R. S. P. Q., 1528; 55-56 V., c. 20, s. 1; 9 Ed. VII, c. 27, s. 13; 6 Geo. V., c. 19, s. 3.

Article 2213a. If while a mine or quarry is being worked, an accident takes place resulting in loss of life or serious injury, the person working the same or his representatives at such mine or quarry, shall forthwith send a written notice to the Minister, specifying the nature of the accident, the number of persons killed or injured and their names if they are known.

Every person not complying with the requirements of this article, shall be liable to the penalties provided in article 2207.

CHEMICAL LABORATORY

The Quebec Bureau of Mines maintains at the Polytechnic School, of University of Montreal, 228 St. Denis Street, an up-to-date well equipped laboratory, for the convenience of the interested public. Analyses and assays, determinations of minerals and tests of various ores, samples, and materials found within the boundaries of the Province of Quebec, are made in this laboratory at prices which are extremely low for the high-grade work done. The laboratory has been established for the sole purpose of aiding the development of the mineral resources of the Province of Quebec. Prospectors and all persons interested in the Quebec mineral resources are cordially invited to avail themselves of the facilities offered. The tariff in force for the analysis and assay of various substances is given further on, and it will be realized that the fees are very low as the high competence of the chemists ensure results of undoubted reliability.

During the year ending December 31st, 1919, the Provincial Laboratory effected 781 analyses and assays, as follows:—

Gold, 244; silver, 108; aluminium, 22; antimony, 2; barium, 1; bismuth, 1; carbon (graphitic), 7; lime, 13; chlorine, 1; chrome, 3; copper, 55; tin, 2; iron, 55; magnesia, 13; manganese, 5; mercury, 1; molybdenum, 1; nickel, 16; phosphorus, 7; platinum, 3; lead, 7; potash, 5; silica, 53; sulphur, 29; titanium, 2; tungsten, 2; zinc, 5; moisture, 26; combustions, 18; radioactivity, 2; calorific power, 2; fuel analyses, 2; qualitative determinations of metals, 68.

Province of Quebec

GOVERNMENT ASSAY LABORATORY

(Under the direction of the Department of Mines of the Province of Quebec as an aid to the development of the mineral resources.)

TARIFF OF FEES FOR ASSAYS AND ANALYSES

DETERMINATIONS	Less than 5 samples Each.	For 5 samples or more Each:
	$ Cts.	$ Cts.
Moisture	0.25	0.25
Combined Water	0 50	0.50
Gold and Silver	1.00	0.90
Silica, Copper, Iron — 1 constituent	1.00	0 90
Silica, Copper, Iron — 2 constituents in same sample	1.75	1.50
Iron, in titaniferous ore	2.00	1.80
Alumina, Cobalt, Graphite, Lead, Lime Magnesia, Nickel, Sulphur — 1 constituent	1 50	1.35
Alumina, Cobalt, Graphite, Lead, Lime Magnesia, Nickel, Sulphur — 2 constituents in same sample	2.50	2.25
Antimony, Arsenic, Bismuth, Chromium, Manganese, Molybdenum Phosphorus, Platinum, Titanium, Zinc — 1 constituent	2 00	1.80
Antimony, Arsenic, Bismuth, Chromium, Manganese, Molybdenum Phosphorus, Platinum, Titanium, Zinc — 2 constituents in same sample	3.50	3.15
Commercial analysis of an iron ore, comprising determination of silica, iron, phosphorus, titaniun and sulphur	6.50	5.85
Commercial analysis of a limestone or cement, comprising silica, lime, iron, alumina, magnesia, and sulphuric acid	6.00	5.40
Commercial analysis (proximate analysis) of a fuel, comprising: ash, volatile combustible, fixed carbon, moisture	3.00	2.70
Caloric power of a fuel	1.50	1.35
Radioactivity of a mineral	1.00	0.90
Radioactivity of a mineral water	2.00	1.80

DETERMINATIONS OF MINERALS.—For a nominal fee of 25c. for each sample, the laboratory will make determinations of ores and minerals, provided rapid tests will allow it, and issue a report on probable contents and commercial value of specimens and samples.

TERMS.—Money in payment of fees, by registered letter, postal notes or orders, must invariably accompany the samples, in order to insure prompt return of certificate.

Professor AD. MAILHIOT,
In charge of Laboratory
No. 228 St. Denis St., Montreal.

MINING OPERATIONS

ASBESTOS

The shipments of asbestos from the producing mines of the Province of Quebec amounted in 1919 to 135,861 tons valued at $10,932,289. To this must be added the shipments of asbestic, a by-product of the mill treatment of the asbestos ore, which totalled 23,827 tons valued at $63,011. For the previous year (1918) the figures for asbestos were 142,375 tons valued at $9,019,-899, and for asbestic 16,850 tons valued $34,046. Therefore while we record a decrease in the quantity of asbestos proper of 4.6% in 1919, as compared with the previous year, the increase in value amounted to 21.2%.

The asbestos industry therefore did not feel any ill effects from the cessation of hostilities; the demand was well sustained throughout the year, as evidenced by the increases in price of the various grades.

The quantity of rock mined and hoisted was 3,061,690 tons. Taking into consideration stocks on hand at the end of 1918 and 1919, there was extracted from this ore a quantity of 154,378 tons of asbestos, of various grades, which corresponds to an average of 100.8 lb. valued at $3.88, per ton of rock mined and hoisted. In 1918, the average was 117.3 lb. valued at $4.08, and 108.7 lb. valued at $3.08 in 1917.

All of the rock hoisted is not put through the mill. A proportion of approximately 15% consists of granite dykes and barren serpentine rock, which is sent direct to the dumps.

The following tables give the detail of the production of asbestos during the two years 1919 and 1918.

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC FOR 1919.

Shipments and Sales			Average Value per ton	Stock on hand Dec. 31st 1919	
Designation of Grade	Tons	Value		Tons	Value
Crude No. 1	1,103	$1,385,627	$1,256.74	366	$ 455,308
Crude No. 2	2,991	1,850,605	618.77	937	539,608
Mill Stock No. 1	13,764	3,057.795	222.15	3,965	752,388
Mill Stock No. 2	69,868	3,704,321	53.02	17,439	989,531
Mill Stock No. 3	48,136	933,941	19.40	10,045	289,931
Totals	135,862	10,932,289	80.47	32,752	3,026,766
Asbestic	23,827	63,011	2.64	1,009	3,999
	159,689	10,995,300	.....	33,761	$3,030,765

Quantity of rock mined during the year 1919: 3,061,690 tons.

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC IN 1918

Designation of Grade	Shipments and Sales			Stock on hand Dec. 31st 1918	
	Tons	Value	Average Value per ton	Tons	Value
Crude No. 1	1,808	$ 1,695,761	$937.92	1,104	$985,449
Crude No. 2	1,896	805,331	424.74	582	122,399
Mill Stock No. 1	13,559	2,221,954	163.87	2,993	586,850
Mill Stock No. 2	32,412	1,852,992	57.17	2,522	154,934
Mill Stock No 3	92,700	2,443,861	26.36	7,033	234,890
	142,375	9,019,899	63.35	14,234	2,084,522
			2.02	375	873
Asbestic	16,850	34,046			
Totals	159,225	$9,053,945		14,609	$2,085,395

Quantity of rock mined during the year 1918:—2,445,745 tons.

The progress of the asbestos industry in the last ten years is shown by the following table of yearly production:

YEARLY PRODUCTION OF ASBESTOS, 1910-1919

Year	Quantity Tons	Value
1910	80,605	$ 2,667,829
1911	102,224	3,026,306
1912	111,175	3,059,084
1913	136,609	3,830,504
1914	107,401	2,895,935
1915	113,115	3,544,362
1916	133,339	5,182,905
1917	137,242	7,198,558
1918	142,375	9,019,889
1919	135,861	10,932,289

By far the greater part of the asbestos produced in Canada is exported in the unmanufactured state. In fact there is in Canada only one manufacture of asbestos products. This is the plant of the Asbestos Manufacturing Company Limited, at Lachine, where are manufactured asbestos slates, shingles, sheating for both interior and exterior use, mill board, paper, corrugated asbestos sheets and air-cell pipe coverings, for both local and export trades.

The United States take about 89% of the production of Canadian asbestos. Some of this is probably re-exported in the raw state from that country, but most of it is manufactured there.

Some seven per cent is exported direct to England and the balance of 3% goes to Italy, Japan, France, and other countries, and a small proportion is manufactured in Canada.

According to the returns of the Canadian Customs Department the exports of asbestos during the year 1919 were distributed as follows:—

EXPORTS OF CANADIAN ASBESTOS IN 1919.

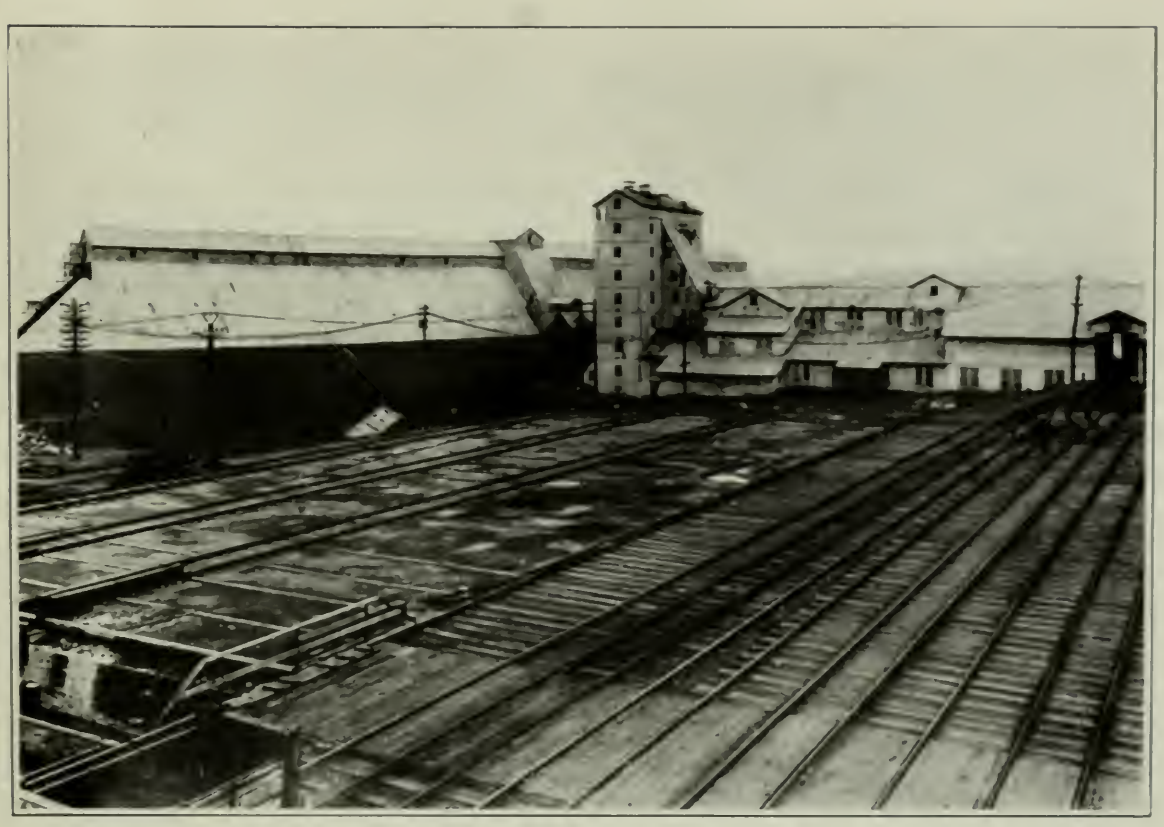
	To the United States		To Great Britain		Other Countries	
	Tons	Value	Tons	Value	Tons	Value
Asbestos fibre, Crude and Mill Stock	95,976	$ 7,232,744	10,500	$ 902,796	3,446	$ 1,490,155
Asbestos sand and waste	26,156	259,875	.....	.....	150	900

Total exports 134,478 tons valued at $9,886,460.

Asbestos mining in 1919.—Returns of production and shipments were received from sixteen operators who worked twenty mines in the districts of Black Lake, Thetford, Coleraine, Danville, Robertson and East Broughton, as follows:—

Asbestos Corporation of Canada, Ltd., Thetford Mines, P. Q.
Asbestos Fibre Mining Company, East Broughton, P. Q.
P. E. Beaudoin, Thetford Mines.
Bell Asbestos Mines, (Inc.), Thetford Mines.
Bennett-Martin Asbestos and Chrome Mines, Ltd., Thetford Mines.
Black Lake Asbestos and Chrome Mines, Ltd., Black Lake, P. Q.
Blais & Fillion, Thetford Mines, P. Q.
Canadian Johns-Manville Co. Ltd., Asbestos, P. Q.
Federal Asbestos Company, Robertsonville, P. Q.
Jacobs Asbestos Mining Co. of Thetford Ltd., Thetford Mines.
Johnson's Company, Thetford Mines, P. Q.
Pennington Asbestos Co., Thetford Mines, P. Q.
Jos. Poulin, East Broughton, P. Q.
Quebec Asbestos Corporation, East Broughton, P. Q.
Quebec Asbestos and Chrome Co., St. Cyr, P. Q.
(1) Frank W. Ross, East Broughton, P. Q.

(1) Shipped from stock on hand. No mining operations.



Asbestos Corporation of Canada, Ltd., King Mine at Thetford Mines, Que.—Railroad yard, crushing and drying plant, and 25,000 ton storage bin

The Canadian China Clay Co. Ltd., St Remi, Amherst Township, Que.—Kaolin washing and Quartzite crushing plant.

Besides the above, six reports of work done on asbestos properties, without having shipped any material, were received.

The *Asbestos Corporation of Canada, Ltd.*, worked its four mines continuously, viz: the King mine, lot 26, range V, Thetford; the Beaver mine, lot 32, range "C", Coleraine; British Canadian mine, at Black Lake station; and the Fraser mine, lot 14, range VII, Broughton.

The King mine is the largest producer of this group. The open pit has reached a depth of over 290 feet. It measures, at the surface, a length of nearly 900 feet, by a width of over 500 feet, and this width is increasing continually. Steps are now being taken to greatly extend the operations. It is the intention of the Asbestos Corporation to remove the soil covering immediately on the north east side of the pit for a distance of several hundred feet, and to carry on an energetic policy of diamond drill prospecting to block out considerable reserves of asbestos rock. A fifth cable-derrick, similar to the four now in use, is being added. These derricks, which are stated to be the largest in the world, each consists of a steel-cable of 2½ inches in diameter, having a span of 892 feet, on which travels a carriage and a hoisting steel box which can raise a weight of ten tons. Each derrick is equipped with a three drum electric hoist of 225 H.P. which lifts the loaded box from the bottom of the pit at a speed of 275 feet a minute, and the traction speed along the carrying cable is 820 feet.

The inclined tunnel and shaft begun in 1915 for the ingress and egress of the workmen is now in use. This inclined passage, from the portal to the bottom of the pit, is some 900 feet long and access to it is by a circular shaft, 9 feet in diameter, 75 feet deep, lined with concrete, equipped with a spiral staircase, which is situated near the public road. This means of access to the pit does away with all the stairways and paths on the sides of the pit which were so difficult of maintenance, besides offering a certain element of danger. Moreover, the men no longer have to cross the railway track of the Quebec Central Railway and the railway yard of the Asbestos Corporation to reach their work, thereby eliminating another serious source of danger from trains and switching operations.

At the Beaver mine, much prospecting has been done by means of two tunnels. One of their tunnels is inclined, rising towards the surface, and will be used by the workmen to give access to the pit, as at the King mine.

At the British-Canadian mine, Black Lake, the development work which was outlined in our report of last year, was continued actively. Eventually, this mine will be entirely worked by the "milling" method, or "glory holes", the ore being hauled out by an electric trolley locomotive, to the crusher bin by an adit, or tunnel; the topography is such that no hoisting will be necessary for a long time to come. The British-Canadian mine, as now understood, comprises the workings of the old British Canadian, the Standard, and the Dominion mines, all adjacent, which are now connected by a system of tunnels; and the ore of all these pits is treated in one large mill. The total length of haulage tunnels passing under the old workings is as follows: the Adit, or main tunnel, enters the side of the hill near the crusher house. The first section is 824 feet long, most of it in superficial deposits and soil, which require strong timbering, with sets made of 8x10 inch timber. Then the haulage track crosses the old pit No. 2, on an embankment 300 feet long. The haulage-way then enters rock and this part of the tunnel extends 1,594 feet, to a point under the old "Upper works". From near the entrance of pit No. 2, a branch tunnel has been driven towards the south, to a point under the "Standard" pit, a distance of 2,038 feet. At various points raises have been driven to the surface, or the bottom of the old pits, for the "glory hole" method of mining.

A large storage bin, of a capacity of 25,000 tons of crushed rock, similar to the one at the King mine, in Thetford, is being constructed, and will render the mill independent of temporary delays in mining operations.

At the Fraser mine, at East Broughton, work was carried on without interruption throughout the year.

At the Jacobs mine, the "glory hole" method of mining is now in full operation, and the work in the open pit is gradually being reduced. The cable-derricks are no longer used for hoisting rock, but are now only an accessory to fill the mine cars at the bot-

tom of the pit. These cars are then hauled to the mill through the 20° incline, which is 1,015 feet long, from the surface to the bottom of the open pit. However, four-fifth of the rock for the mill comes from the glory hole operations and is hoisted by the shaft. The intention is to eventually use the incline for the circulation of the men only, thereby doing away with all outside ladders which are costly of maintenance, and which in winter, offer a certain amount of danger owing to the coating of ice and snow.

At the Bell mines the two pits are now connected by an opening. The lower third of the incline tunnel, through which practically all the rock is hoisted to the mill, is situated in the wall or pillar, which separates the two pits, and as it is the intention to mine this rock, the tunnel will be abandoned for hoisting. A new incline, started from the western end of the main pit will replace it, and is now nearing completion. It will be about 1,200 feet long and will reach the surface near the crusher house.

The interests of the Martin-Bennett Asbestos Mines, Thetford, and of the Bennett-Martin Asbestos and Chrome Mines Co., Coleraine, have been amalgamated under the name of *Bennett-Martin Asbestos and Chrome Mines, Limited*, with head-office at Thetford, and they are operating both the Thetford mine on lot 27, range V, Thetford, and the Vimy Ridge mine, lots 23 and 24, range III of Ireland. Both mines have been worked without interruption. The Vimy ridge mine is giving great satisfaction, and the quality of the crude asbestos which it produces, improves with depth. Near the surface the fibre was rather harsh, but it is now much more silky.

The serpentine rock of the Vimy mine appears to be somewhat harder than at Thetford, with the consequence that the life of the beaters of the "Cyclones" in the Vimy mill is less than half than in Thetford.

The main workings at Vimy now measure 650 feet in length, along the side of the hill.

During the latter part of the year, the quarry of the "Reed" property, lot 29, range "A" of Coleraine, was leased and worked by *Messrs. Blais & Fillion*, who constructed a small mill of a capacity of 40 to 50 tons a day. The results have been satisfactory.

In the East Broughton district, great activity reigned throughout the year. The mines in operation in 1919 were the *Quebec Asbestos Corporation* (Ling Mine); the *Asbestos Fibre Mining Company*, Eastern Townships mine, acquired in 1918 by E. H. Garcin and associates; the Fraser mine, owned by the *Asbestos Corporation of Canada*; *Jos. Poulin*, who, in 1918 leased the mine on lot 13 H and I, range VII Broughton, on which he constructed a small mill.

THE ASBESTOS DEPOSITS OF QUEBEC

The asbestos deposits of the Province of Quebec, which at present supply between 85 and 90% of the world's consumption occur in long narrow band of serpentine rocks, which enters Canada from the south, near Lake Memphramagog, crosses the Eastern townships in a north-easterly trend, and extends, with gaps, as far east as Gaspé peninsula. But as far as at present known, the workable deposits of absestos are confined to (1) that part of the band which extends from Coleraine to East Broughton, a length of some 25 miles in the counties of Megantic, Wolfe and Beauce, and (2) to a small area of serpentine in the vicinity of Danville, in the county of Richmond. It may be mentioned, however, that occurrences of asbestos-bearing rock have been recognized all along the trend of the "Serpentine Belt", but so far none found south of the Danville area, or north of the East Broughton district, have been worked.

There are now six producing centers of asbestos, the most northern one of which is East Broughton, situated sixty miles south of Quebec city; then Robertson, ten miles further south, followed by Thetford Mines, Black Lake and Coleraine, all on the line of the Quebec Central Railway, which joins Quebec to Sherbrooke. The sixth center is at Danville, eighty miles south-east of Quebec, on the Grand Trunk Railway.

The extreme occurrences of asbestos rocks in the serpentine belt are over four hundred miles apart. The most southern one is near the Vermont boundary, at Mansonville, while the most north-easterly ones are in the Gaspé peninsula, where outcrops of serpentine carrying veins of short fibre asbestos have been observed at various places, viz: at Mount Albert, in Weir township, and at Mount Serpentine, on the Dartmouth river.

In our report of last year, mention was made that a discovery of asbestos had been reported from the Lake Temiscamingue district, in Gaboury township to the south of Lac des Quinze. This occurrence was hastily visited by an officer of the Quebec Mines Branch in September 1919. The serpentine rock, carrying in places small veins of cross fibre asbestos, and large quantities of slip-fibre, outcrops on the east bank of a depression which is occupied by a small shallow lake, called lake McKenzie. It is in contact with compact green Keewatin schistose rocks, and only a narrow band of the serpentine is visible, the rest of the development of this rock being hidden under the silt deposits and the waters of the lake, the depression being perhaps due to the weathering of the soft rock. The contact between the Keewatin rock and the serpentine was followed along the shore for over half a mile, and appears to extend much further south. Its strike follows the bank of the lake W. N. W., where observed. A claim was staked on this part of the occurrence by Mr. Nap. Bouchard, of Lorrainville, and this ground is now under mining license.

This occurrence is too far from means of easy transportation to be of much interest at present, even if further prospecting showed asbestos present in economic proportion. It is situated in the unsurveyed part of the township and the only means of access is by canoe, when the water of the creek of the discharge of the lake is sufficiently high. The distance by canoe is about ten miles from the nearest road.

Uses of asbestos.—Asbestos is a generic name given to various minerals whose characteristic features are a fibrous structure, incombustibility, resistance to corrosive liquids and substances. These minerals can be fiberized into threads, spun and woven into fire-proof fabrics. The members of this class of substances which are used in the arts and the industries are:—*Chrysotile* a hydrated silicate of magnesia, belonging to the serpentine group, which is the most prized. Chrysotile asbestos is white in colour and can be reduced to threads, delicate and silky; it is eminently suited to the manufacture of textiles. It can be submitted to temperatures of 4,000° F. without alteration, and is a non-conductor of heat and electricity. *Crocidolite* is a silicate of iron and sodium. It is easily separable into threads which can be spun and woven,

but are harsher than chrysotile. It is of a lavender blue colour, and cannot stand as high temperatures without alteration. *Amphibole asbestos*, a silicate of lime and magnesia, is pale green in colour, and the threads, although long, are more brittle than any of the other asbestos. It is very little used. *Amosite*, is a new variety of asbestos observed for the first time in 1917 in the Lydenburg district in the Transvaal, Union of South-Africa. In our last year report we gave an extract from an article by Dr P. A. Wagner, contributed to the South African Journal of Industries, in which, speaking of this new asbestos which bids fair to give rise to an important industry, he said: "It is undoubtedly an amphibole "asbestos, apparently monoclinic. It differs from tremolite and "actinolite in containing up to 37% of ferrous oxide; from croci- "dolite in being quite free from soda; and from all these minerals "in containing up to 9.3% alumina". Since the above was written this mineral has been determined as a new variety to which the name Amosite has been given.

Of all the above varieties, chrysotile is the most important, although crocidolite is also used in increasing quantities. As to the Amosite, it is yet too early to ascertain what importance it will take, but a great future is predicted for it.

The asbestos produced by the mines of the Province of Quebec is exclusively of the chrysotile variety and these mines supply between 85 and 90% of the world's present consumption. The great demand for the Canadian asbestos, and the phenomenal increase in the prices, (these have more than trebled within the last five years) are due to an extension and a development of the known uses rather than to new applications and utilizations. The long fibre qualities are spun and woven into fire-proof fabrics which are utilized for theatre fire curtains; gloves, leggings, spats, aprons worn for protection against excessive heat and molten metal spattering, in steel mills, blast furnace plants, smelters, foundries. But by far the greater bulk of the asbestos produced is used in the manufacture of steam packings and packing sheets, washers, gaskets of all of which there are innumerable varieties; of insulating tubes, tapes and wire coverings, used in electricity; of brake linings for hoists, automobiles, elevators and other machinery; of heat insulating coverings for steam pipes and of loco-

motive and stationary boiler laggings; fire-proof felts and papers. A large quantity of asbestos is also used in the manufacture of fire-proof building materials, such as asbestos shingles, asbestos boards and lumber, corrugated roofing and sheating which are composed, in the main, of Portland cement to which is added a proportion of 15% of asbestos fibre.

Asbestos cloth has of late been used in the manufacture of automobile tires, to replace the other ducks. It is claimed that such "asbestos protected tires" can give a much greater mileage than those manufactured with vegetable fabrics.

ASBESTOS IN OTHER COUNTRIES

United States.—According to Mr. J. S. Diller, of the United States Geological Survey, the United States production of asbestos in 1918 shows a marked decrease, in quantity and in value, as compared with the previous year, despite a very brisk demand and an increase in the prices. The total quantity produced in 1918 was 802 tons valued at $121,687, while in 1917, it had been 1,683 tons valued at $506,056. Five states contributed to this production, viz: Arizona, California, Georgia, Maryland and Oregon. Of these, Georgia and Maryland produced amphibole asbestos, or "slip fibre". The Georgia asbestos is used in the manufacture of fire-proof cements and paints, while the Maryland asbestos finds application in the chemical industries as filtering material.

According to the monthly reports of the United States Bureau of Mines "an asbestos claim has recently been located in Apache "county, Arizona (February, 1920). The deposit is said to be "extensive, having been traced over 20 miles. Vein exposures are "so prominent that according to report, one can, without aid of "miner's tools, pick up a ton or more of crude asbestos that has "broken down from exposures. Material from the deposit, exam-"ined at the U. S. Bureau of Mines, is of the typical Arizona type. "It is strong, flexible, silky, and occurs in cross-fibre veins, with "fibre length of one to one and a half inches, while fibre of two and "a half inches in length has been reported."

In Virginia, according to the same authority, several out-crops of serpentine have been located near Great Falls, Fairfax

county, Virginia, which hold cross-fibre asbestos. Although the veins are small and irregular, the occurrence is remarkable inasmuch that in the asbestos-bearing belt of the Eastern United States, from Vermont to Alabama, all the asbestos found previously has been of the amphibole type, while the occurrence near Great Falls which is situated in the belt, is chrysotile.

Rhodesia.—The production of asbestos in Rhodesia in 1919 shows a very substantial increase as compared with the previous year. According to the Rhodesia Chamber of Mines, the figures for the year ending December 31st 1919 were 9,739 gross tons, valued at £425,240. In 1918, the production was 8,574 tons valued at £158,684. This is therefore a proportional increase of 14% in tonnage and 168% in value. That the importance of the Rhodesian asbestos industry is incerasing very fast is shown by the fact that the value of the production of this substance in the table for 1918 occupied fourth place while in 1919, it ranked second in the table of the mineral production of Rhodesia, being surpassed by gold only.

Union of South Africa.—The figures of production of the Union of South Africa for 1918 have shown a marked decrease. From 6,220 gross tons valued at £87,364 in 1917, they fell to 3,674 tons valued £54,037, made up mainly of Cape asbestos or crocidolite. The reason ascribed to this falling off, is that asbestos not having been classed as a war mineral, it suffered very much from shortage of freight and labour difficulties. There was no lack of demand for the material, but there were no facilities to get it to the market.

The new discoveries of amosite, the grey and greenish white amphibole asbestos found in the North Lydenburg district, have been developed actively, and a great future is predicted for this material. At present the lack of roads militates against the industry, as the deposits are 65 miles from the nearest railway point, which is Lydenburg.

Amosite asbestos occurs in cross-fibre veins in siliceous slates. Great length of the threads is a characteristic of this mineral, as they vary from two to seven inches, a maximum of eleven inches having been observed. The fibre is reported to be strong and soft well adapted to spinning. Some shipments of amosite are reported to have been made to the United States.

China.—Asbestos deposits are irregularly worked in South China. The province of Szechuan is the most promising as regards this mineral. The asbestos is chrysotile, but mining has not gone down deep and the fibre produced appears to have been weathered. Little mining has been done, but with a steady demand the Chinese would go deeper. It is impossible to give accurate figures of production, but at the outside they would not exceed 300 tons annually. (Abstract from a communication from Commercial Secretary British Legation, Peking).

CHROMITE

The production of chromite amounted to 8,184 tons of shipping ore and concentrates, representing a value of $223,331. Of these some 3,000 tons was lump ore (crude) which did not require concentration, and the balance of a little over 5,000 tons was concentrates, produced from the treatment of ore which was of too low grade to ship without milling and concentrating.

The lump or crude ore had an average content of 35 to 38 per cent of sesquioxide of chrome, and the concentrates in the vicinity of 50 per cent.

This is a serious falling off as compared with the previous year ,when the figures were 23,000 tons of ore shipped valued $770,955. But as chromite was a war-mineral, such a decrease was expected with the cessation of hostilities. That the United States shared this condition of affairs is apparent from a review of the chrome industry published in the Engineering and Mining Journal, of January 17, in which it is stated that "owners and oper-"ators of American chromite deposits devoted their efforts during "the year (1919) to an attempt to have the domestic industry "protected by a tariff, and to efforts to collect from the War-"materials Relief Commission the losses sustained during the war "period. Production was almost at a standstill".

Returns of shipments of chromite were received from four producers. That the operators have faith in the future of the industry is shown by the very large sums spent by several companies in development work and mill construction.

The Belanger mine, on lot 19, S. E., range X of Coleraine was acquired by the *J. V. Bélanger Mining Company, Ltd.*, and although work was at a comparatively standstill during the first months of the year, activity was resumed in July. By the end of the year the shaft had been continued to a depth of 80 feet, and 300 feet of underground development drifting had been done. But most of the ore milled or shipped came from the open cut situated close to the line of the Mutual Chemical Co's property, the two mines being located on the same deposit.

The Bélanger mill ran comparatively steadily, but a new large mill is being erected and is expected to be in running order by the middle of May, 1920. This mill is equipped for a feed capacity of 170 tons of lean ore per 24 hours. This ore averaging in the vicinity of 12% of sesquioxide of chrome is expected to be concentrated in the mill to a content of 50%, with a recovery of 80% of the original tenor. The equipment of the mill comprises two jaw crushers, a Hardinge ball-mill, trommels, Allan cone classifiers, six Butchards tables and six Deister-Overstrom tables, the latter to treat the "middling" of the first tables. Electric power to be used exclusively.

The Mutual Chemical Company of Canada, Ltd., operates on the same deposit on the adjoining lot 19 N. W., range X of Coleraine. Considerable underground development work has been done during the year. The shaft is now 206 feet deep, and on December 31st there was 1,299 feet of drifting done on the 100 foot level, and 2,105 on the 200 foot level.

Until the middle of August this company operated the concentrator of the Black Lake Asbestos and Chrome Co., locally called the Lakeside mill, or Red mill, a description of which was given in our report for 1917. Shortly after, the construction of a new mill was begun at the mine itself and it was completed in March, 1920. The greater part of the machinery came from the dismantlement of the St. Cyr mill of the Quebec Asbestos and Chrome Co., a short description of which was given in our report last year. It may be mentioned that this machinery was originally put up in 1916 by the Mutual Chemical Company in a new mill constructed at the old American Chrome Company's mine, which deposit, on further development proved disappointing.

Mutual Chemical Co. of Canada, Ltd.,—Shafthouse at chrome mine on Lot 19 N. W., range X, township of Coleraine, Que.

Black Lake Asbestos and Chrome Co. Ltd.,—Shafthouse at Caribou chrome mine block A, township of Coleraine, Que.

The new mill is giving very good results and has a capacity of 150 tons of feed ore per day.

The Black Lake Asbestos & Chrome Company, Limited.— Actively pushed the development work begun towards the end of the previous year on their Caribou mine, on the northwest shore of Caribou Lake, block "A" of Coleraine township. The shaft which was started at the end of November 1918 has been sunk to a depth of 200 feet. It is situated some 45 feet north-east of the main old open workings, the intention in placing it there being the development of the extension, in depth, of the zone of lenses of chromite which were previously worked by open-cast pits.

The underground development work, apart from the shaft, comprises 650 feet of drifting and cross-cutting, on the first level, which is at 115 feet, and some 1,500 feet on the second level, at 188 feet.

The head frame of the shaft is of timber, and 55 feet high, boarded up. It is a three compartment shaft, measuring 13½ by 5½ feet. Two of the compartments are for hoisting cages and the third for ladders. The ore is hoisted on small mine cars which are trammed on the cages. These are equipped with safety dogs, steel hoods, and railings. The hoist is in a separate building and is a two-drum one.

The ore is sorted underground and the gangue is used as filling material. On reaching the surface the ore is dumped on a shaking screen of one inch mesh. The screenings of this operation are treated in pulsating jigs, and the oversize is once more sorted into shipping ore and rock. The shipping ore, both lump and jig material, averages between 38 and 40% $Cr^2 O^3$.

The *Quebec Asbestos and Chrome Company*, who successfully developed an important deposit of chrome at St. Cyr, on lots 7 and 8, range X of the township of Cleveland, worked only during a part of January. Apparently the operators anticipated a fall in the prices of chromite, below the remuneration margin at which the St. Cyr ore could be produced, and the concentrating mill was sold, dismantled and returned to Black Lake where it was re-erected by the Mutual Chemical Company of Canada. The

deposits at St. Cyr were far from exhausted when the mine closed; but the ore is essentially of concentrating grade, like most of the Quebec ore, and under the old conditions of prices, when Rhodesian chromite could be delivered in New York for $14 a ton, there would be no possibility of making ends meet. However although the abnormal war prices have somewhat weakened, quotations for chrome ore throughout the year have been far higher than before the war, and the Engineering and Mining Journal, in its review of the year gives the range at $13.00 to $63.00 per short ton, for ore ranging from 34 to 51%. Towards the end of the year, the New York quotations were 65c. to 85c. per unit and the demand strong. Under such conditions it is possible that the St. Cyr deposits might be operated remuneratively.

In December 1919, a bill was presented to the U. S. Congress, providing for a tariff duty on imports of chrome and their products, as follows:—

"First, on crude chrome ores and chromium ores and con- "centrates thereof, the sum of 60c. per unit of Cr^2 O^3 content "therein contained, a unit being defined 1 per cent of Cr^2 O^3, contained in a net ton of 2,000 lb.

"Second, upon ferrochrome, and other metallic alloys "con- "taining chrome, 11½c. for each pound of metallic chromium "contained therein.

"Third, upon refractory brick and material used for refractory "purposes containing chrome, the sum of 65c. per unit of Cr^2 O^3; "a unit being defined as being 1 per cent of Cr^2 O^3, "contained in a "net ton of 2,000 lb.

"Fourth, upon chemical compounds and articles manufactured "therefrom containing chrome or chromite, 90c. per unit of chro- "mium content; a unit being defined as being 1 per cent of chromium "contained in a net ton of 2,000 lb."

In February, 1920, the measure had reached the stage of being introduced before the U. S. Senate.

If this tariff becomes effective, it will have a very detrimental effect on the Quebec chrome industry.

CHROME IN OTHER COUNTRIES

United States.—According to S. H. Dolbear (1), the inertness

(1) *Engineering and Mining Journal*, January 17th, 1920.

of the chromite mining industry in the United States in 1919 was in marked contrast with the feverish activity which prevailed throughout 1918. In the latter year there were nearly 600 active owners and operators of chrome properties, many of whom actually produced ore, whereas during the first six months of 1919, only three mines were reported to have mined and shipped ore to the amount of 1,400 tons. In 1918 the shipments for the year had totalled, 82,350 long tons of all grades, produced by California, Oregon, Maryland, North Carolina, Washington, and Wyoming, in order of importance.

Rhodesia.—During the year 1919, the production of chrome ore from the Selukwe deposits was 35,282 long tons valued at £142,541, or £4, 0s. 8d. per ton. That the conditions and costs of mining have changed in Rhodesia as well as everywhere else is apparent from the fact that in 1913 the production of chrome ore from these deposits was 63,384 long tons, valued at £141,481 or £2, 2s. 3d. per ton.

India.—During 1918, deposits of chromite at Bairapur, in the Native State of Mysore, were operated under a government license, and produced 30,000 tons of 50% ore. Another deposit of importance is known at Navely, in the same state, shipments carrying over 50% Cr^2O^3. This and other deposits of somewhat lower grade are reported capable of producing 1,000 tons per month. (1)

Cuba.—In a very detailed and complete paper on the "chrome ore deposits in Cuba", read by Mr. Ernest F. Burchard before the American Institute of Mining Engineers, the following conclusions are reached:—

"The reserves of marketable chrome ore in Cuba were esti-
"mated by Mr. Burch and the writer to range from 92,500 to
"170,000 gross tons, practically all of it in Oriente and Camaguey
"provinces. The largest known deposits—those of the Caledonia,
"Cayoguan group, and Potosi claims—are near the north east
"coast of Oriente, in a region difficult of access. Together they

(1) *Engineering and Mining Journal*, January 17th, 1920.

"may yield 72,500 to possibly 130,000 tons of material, most of "which can be brought to present commercial grade by simple "near Cameguey. They are easy of access but are of lower grade "near Cameguay. They are easy of access but are of lower grade "than those in Oriente Province. They appear to contain 20,000 "to 40,000 tons of ore, most of which can be gathered by hand "from the surface

"Near Matanzas, Cardenas, and Holguin there are a few "deposits of ore so small they can hardly be regarded as of com- "mercial importance. The ore near Holguin is of medium grade, "but that near Matanzas and Cardenas is generally of lower grade "The expense of hauling is reported to be almost prohibitive."

COPPER AND SULPHUR ORES

During the year 1919 the mines of copper and sulphur ores of the province shipped 53,965 tons, valued at $447,623. The shipments during the previous year had totalled 125,446 tons valued at $1,319,690. We therefore record a decrease of 71,481 tons or 57% in quantity, and of $872,057 or 68% in value for 1919, as compared with 1918.

The copper contents of the ore shipped amounted to 5,751,188 lb. A substantial proportion of this metal is to be credited to the shipments of high grade ore from the Huntingdon mine, re-opened and operated by the Eastern Mining and Milling Company.

The great majority of the pyritous-copper ores of the Province of Quebec consist of copper-bearing iron pyrites which are used for the manufacture of sulphuric acid, the residual cinder being then treated for the extraction of copper. They were therefore essentially "war minerals" and the decrease in the output was expected, although it was not anticipated that the cessation of hostilities would have been felt to this extent. The shipments in 1919 were much below the pre-war production, which was 117,778 tons in 1914. This can be ascribed to the fact that at the signing of the armistice, large stocks of pyrite had been accumulated by the manufacturers of sulphuric acid, and owing to the falling off of the demand, operations at the mines were greatly reduced. This situation was further aggravated by the active campaign of the

United States crude sulphur producers to market their products. Towards the end of the year, crude sulphur (99 to 99½%) was offered at 14 to 15 dollars a ton, on cars at the mines, in Texas and Louisiana. At this rate it is very difficult for pyrites to compete. Another disturbing element was the fact that a new company, the Texas Gulf Sulphur Company, began to produce at the rate of 1,000 tons a day, in April, and this production has since been increased to 1,500 tons.

Returns of production of pyrites were received from three producers.

The *Eustis Mining Company*, operating the Eustis mine, south of Sherbrooke, did some mining during the first three months of the year. In April all mining work was stopped, owing to the dulness of the demand, and activities were confined to keeping the concentrating mill working below half capacity, using ore from the old dump. This state of things continued until the end of the year, when the mine had not yet re-opened. Advantage was taken of the lull to do a great deal of repairing in the shaft and underground workings.

At the Weedon mine, operated by the *Weedon Mining Company*, the activities were also greatly reduced during the year, but the mine did not close down, having been 302 days in operation.

The shaft, which in 1918 reached only the 10th level (840 feet) has been further sunk to the 11th and is now 965 feet. On this level several diamond drill holes were bored, both in depth along the dip of the deposit, and horizontally, at right angle to the strike, with satisfactory results as to reserves of ore. The deposit becomes noticeably narrower, but this is compensated by a much higher copper content.

The *Eastern Mining and Milling Company, Ltd.* made some important shipments of concentrates, from the treatment of part of old dumps of the Huntingdon mine, and from ore mined in open workings. Work was discontinued during the first part of the year, but when the price of copper improved, activities were resumed. Steps were taken to reopen the underground workings

of the mine and to greatly enlarge the mill, the capacity of which will be extended from the present 60 or 70 tons of feed-ore a day, to 250 tons. The main inclined shaft was pumped out, down to the 200-foot level, and development work was pushed actively. A new compressor of 1040 cub. feet of air has been erected, worked by a 200 H.P. motor, and from all appearances this mine will be an important producer of copper ore in 1920. The concentrates from the Huntingdon mine are high grade, assaying 10 to 18% copper, and the sulphur content is not used for the manufacture of sulphuric acid. The shipments are made direct to the smelter.

MOLYBDENITE

Only one report of production of molybdenite was received for the year 1919. This was from the Dominion Molybdenite Company, who successfully developed and operated the Moss mine, in Onslow township, lots 9 and 10, range VII in 1917 and 1918 and part of 1919, and who shipped 83,002 lb. of molybdenite valued at $69,203 during the last year.

After the signing of the armistice the demand for molybdenite fell off considerably, and the Dominion Molybdenite Company gradually curtailed its operations, owing to the lack of market, until it finally closed down altogether on March 10th, 1919.

The deposit on which is situated the Moss mine is quite a large one, and was far from exhausted when operations ceased. The workings consist of an open pit 150 feet long, 65 feet wide and 125 feet deep at the north end. In 1918 the system of mining was changed to the "glory hole" method, and hoisting was by shaft 200 feet deep, on an inclination of 70^0. When the mine closed down, a cross-cut had been driven from the bottom of the shaft, 100 feet towards the deposit, and from the end of this cross-cut, drifting had proceeded 100 feet towards the north and 60 feet towards the south. In the last ore treated 12 lb. of molybdenite were recovered per ton of ore treated in the mill, which represented an extraction of 96 to 98% of the molybdenite contents. The concentrates assayed between 90 and 95% Mo S^2.

The mill practice was very efficient and the loss of molybdenite in the tailing was remarkably small, averaging two-tenths of a lb. per ton of tailing. A detailed description of the practice was given in the Engineering and Mining Journal, number of April 10th, 1920, and part of the article is here reproduced:—

"The following is a description of the milling process used by "the Dominion Molybdenite Co. in concentrating molybdenite "ore at Quyon, Quebec..... The average ore assays 0.5 to "0.75 Mo S^2, and also carries pyrites, which is generally in excess "of the Mo S^2, and at times runs as high as 3 to 5 per cent. The "ore contains little copper, as the concentrates carry only 0.1 per "cent.

"Reduction to 2-in. size is accomplished by a Blake crusher "the product going to a 6-ft. Marcy mill in closed circuit with a Dorr "classifier, the overflow passing 40-mesh. A mixture of No. 5 "General Navy Stores pine oil and kerosene is fed into the ball "mill with the ore. As a result of grinding the oil with the ore, "a large percentage of the Mo S^2, as soon as freed from the gangue, "floats out of the discharge in large flakes and materially aids "subsequent treatment. These masses at times measure $\frac{1}{8}$ in. "in diameter.

"From the ball mill, the pulp is elevated to a set of Callow "cells. The capacity of the mill is 150 tons in twenty-four hours, "and four single cells are capable of handling this tonnage. The "rougher concentrate assays 10 to 15 per cent Mo S^2, and about "the same in Fe S^2, the remainder being fine gangue, which is "carried over mechanically by the froth. This concentrate falls "directly to the two cleaner cells.

"The cleaner cells are operated differently from the usual "practice. Sides are put on the cells to prevent the froth over-"flowing and to cause it to build up to a depth of 14 to 18-in. and "in this froth a selective action takes place. The gangue settles "out of the sulphides; also most of the pyrite falls out. The "upper stratum of froth, being the richest in Mo S^2, is allowed to 'discharge through an opening 1 in. wide in the end of the cell. "The concentrate from the cleaners assays from 60 to 70 per cent

"Mo S^2, and the particles are well flocculated, due to the quiet "prevailing in the cells. The blanket bottoms must be kept well "cleaned and all boiling avoided, otherwise the grade of concentrate "will be reduced.

"The cleaner concentrate falls to an 80-mesh Callow screen "and is washed with a water spray to remove the last of the pyrite "and adhering gangue. The concentrate is removed on the under "side of the screen by a spray of water, and falls into a dewatering "tank from which a scraper continuously removes it to a drier. "This finished concentrate assays from 85 to 95% Mo S^2, and "2 to 3% Fe S^2, the remainder being gangue.

"The cleaner cells operate in closed circuit; the fines from "the Callow screen join the tailings from the cleaner cells and flow "into the elevator boot, to be thoroughly mixed with fresh pulp. "This results in a material reduction of the amount of oil necessary, "and aids the recovery. The restricted overflow of the cleaner "cells causes the tailings of these cells to be very high in Mo S^2 "and results in the building up of sulphides in the whole circuit. "Consequently, careful manipulation is required in operating the "rougher cells to maintain an even froth, otherwise a large loss "may result in the tailings in a short time. A check is obtained "on the operation by an automatic sampler placed in the tailing "launder.

"The results obtained are remarkable, as the regular monthly "mill sheet shows: Feed 0.7 per cent Mo S^2; concentrate 90 per "cent; tailings, trace. Oil consumed 0.5 lb. pine oil and 1 lb. "coal oil per ton of ore. The recovery rarely falls below 98 per "cent over a month, and temperature changes are without effect "on the operation of the grade of the product."

Work was done on only one of the numerous molybdenite prospects and occurrences which are known in the district to the north of the Ottawa river, between the Gatineau river and Waltham. This was on the Daley prospect, in Thorne township, a shaft 7x9 has been put down 50 feet, and at the bottom some 47 feet of drifting has been done.

It may be mentioned here, for record, that the *Standard Molybdenite Company* who controlled some alleged workable molybdenite deposits in Egan township, near Maniwaki, went into liquidation. This company in 1917 and 1918 issued very flashy prospectus and literature, inviting the public to subscribe for shares in the company, and for some time it maintained offices in both Ottawa and Montreal.

No work was done during the year on the claims of *L. N. Benjamin*, in La Corne township in the Abitibi region, but the occurrence was examined in detail for the Bureau of Mines by Mr. Mailhiot, of the Polytechnique School, Montreal, and his report is given below.

The *St. Maurice Mines Company*, who owns molybdenite properties on Lake Kewagama, Abitibi district, carried on some development work, and constructed a concentrating mill, with the Groch flotation process. A trial run was made, but owing to the lack of market for molybdenite, both mine and mill closed down, pending improvement in the demand.

Molybdenite is another of the minerals which keenly felt the conclusion of the war. In January 1918, the market price of molybdenite in the United States was $2.25 to $2.30 a lb. in January, 1919 it had fallen to $0.85, and for the remainder of the year the quotations given varied between $0.75 and $0.90, with very few transactions, these prices being apparently nominal. In some instances, some sales to liquidate stocks were made at much lower prices, and, in at least one case, some 25,000 lb. of material, 90% MoS^2 and over, without deleterious elements, changed hands at $0.50.

Towards the end of the year interest in molybdenum began to revive and it is quite possible, not to say probable, that the demand and the market will improve in a near future. The effects of molybdenum in steel are very similar to those of tungsten and the percentages of the former required to obtain the same results are from three to five times less than of tungsten. Both impart to steel hardness and toughness, and make the best tool steels. But the manufacture of molybdenum steel requires much

greater care and skill, in observing the proper proportions, and in the annealing process. In careless quenching and preparation, molybdenum steel is much more liable to develop flaws and cracks. The future of molybdenum steel would seem to lie in the manufacture of parts of automobiles and airplanes, and before it is widely used its metallurgy and the practice of its manufacture will have to be better known, developed and stabilized. In fact, the announced discovery of Professor Arnold, which figured widely in press reports throughout the world at the close of the year 1919, regarding a molybdenum steel with remarkable properties, does not seem to be anything startlingly new, but is more of the nature of a step towards the fixation of the metallurgy and the manufacture of molybdenum alloys. It may be observed that the manufacture of tungsten steels went through a very slow evolution before it attained its full development. Tungsten steels were manufactured for their special properties, as far back as 1860, but it has been only within the last twenty years, after much study, research and tests, that the tungsten alloys industry has developed to any extent.

Molybdenite deposits of La Corne township, Abitibi, Que.

by Adhémar Mailhiot (1)

In compliance with instructions received from Mr. Théo. C. Denis, Superintendent of Mines of the Province of Quebec, the writer spent a few days, in August 1919, on the Eureka claims, in La Corne township, county of Temiscamingue, to make a geological examination of the molybdenite deposits.

The property is situated in the south west corner of the township of La Corne, some thirty miles south of the town of Amos. The mine is reached by going up the Harricana river, and crossing the lake expansions, to a point two miles above the inlet of lake Malartic, where the operating company constructed a wharf and landing.

From this point, a colonization road, cut and partly built can be followed to the mine, a distance of two miles.

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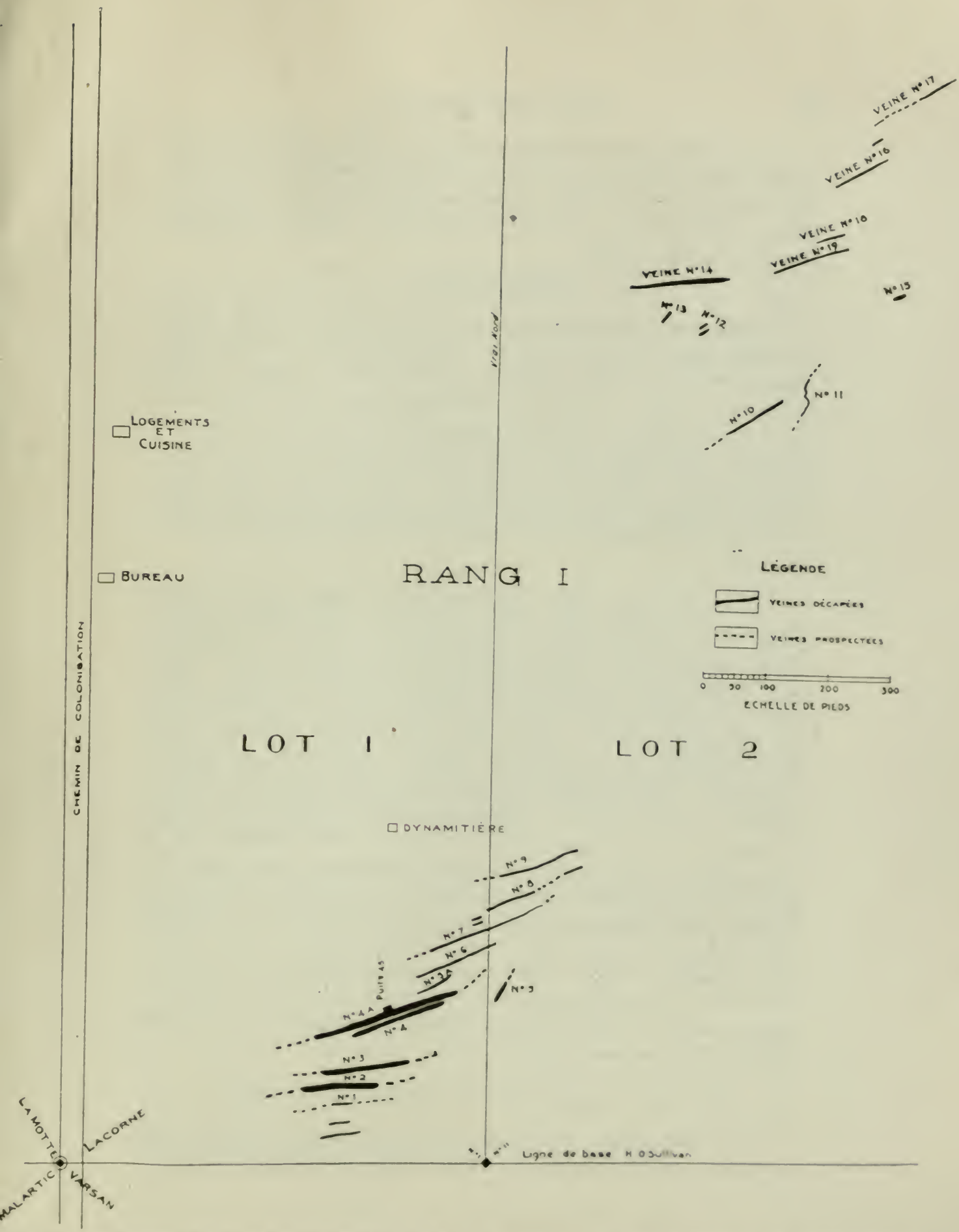

FIG. 1.—Molybdenite. Plan of system of veins on Eureka property, lots 1 and 2, range I, La Corne township.

As to the geographical position of the district, means of access and of communication, topography, previous exploration and general geology of the region, we refer the reader to our report on "The Gold Deposits of Lake DeMontigny, Abitibi", published elsewhere in this volume.

General Geology

Geologically, the oldest rocks of the district belong to the "Abitibi group". They comprise a complex of igneous rocks both extrusive and intrusive, together with bands of highly altered sedimentary rocks. These ancient sedimentary rocks are represented on the property of the Eureka mine by the bands of micaceous schistose rocks which have been cut by granite masses and pegmatite veins. These "Abitibi group" rocks occupy a vast area along the Harricana river from beyond the town of Amos to the north, to the Thompson river which flows into Lemoine lake to the south.

These old rocks were invaded later by huge masses of acid rocks of pre-cambrian age, through all this part of the country. These intrusions are mainly granites and rock types which have been evolved from the differentiation of a granitoid magma. The hills of the northern and central parts of La Motte township, and the prominent hills of the central and southern portions of La Corne township are composed of granite. The prevalent type is a quartzose biotite granite frequently displaying pegmatite characteristics, as in the case of pegmatite dykes in which molybdenite is found on the Eureka property, associated with sericite and a little pyrite. At the mine, the main batholithic granite mass has penetrated the Abitibi rocks in the form of apophyses and tongues. The pegmatite dykes are clearly subsequent to the granite intrusion, and represent the last stage of the igneous activity in this region. The pegmatite matter was accompanied by sulphurous vapours, which have impregnated the nests of sericite in the dykes, and the vapours seem to have also penetrated the pegmatite itself while it was still in a viscous state.

Economic Geology.—General character of the deposit

The development and prospecting work has been done to date on the two claims forming the southern part of lots 1 and 2, range

I, La Corne township, forming an area of 70 acres. Moreover, the work has been limited to the parts of these lots where the superficial layer of loose material was sufficiently thin to reach the rock with the least cost.

In the cleared part a series of pegmatite veins were uncovered along the contact between a biotite granite and a mica schist; some of these pegmatite veins cut the mica schist, but there exist always tongues of granite at the spots where the mineralization is more abundant. The presence of granite has an influence upon the richness of the mineralization.

The veins have a general direction N, 70 to 80° E, and dip 40 to 70° to the south. They constitute a system of close parallel veins disposed in echelons over a cross distance of about 600 feet. Their individual width varies from a few inches to several feet.

Test pits have been put down on most of the veins and on vein No. 4A a shaft 7 x 8 feet has been sunk to a depth of 45 feet along the inclination of the dip. The shaft was full of water at the date of my visit. In this vein, the mineralization took place in the sericite schist which forms lenticular masses along fissures in the pegmatite. These fissures are irregularly distributed in the pegmatite from the centre to the walls. The quartz and the feldspar of this pegmatite vein are also well impregnated with molybdenite, and then this mineral lines pockets, and crystals are found of larger size than those disseminated through the sericite where the molybdenite is fine grained.

The description of the mineralization of vein No. 4A can be applied to all the veins of the property. Prospection trenches made upon different veins show the same order of mineralization.

Besides these big veins there exists a distinct series of small stringers of variable direction. The veins Nos. 8, 9, 11 and 15 on the plan belong to that group. Their widths vary from 1 inch to 15 inches and molybdenite is frequently accompanied by fluorite and molybdite. Whenever these stringers cut the black mica schist, they contain no sericite, but only quartz and feldspar; on the other hand when they cut the granite the molybdenite is disseminated through the sericite which is very abundant.

Development and prospecting work on the property consists of trenches and a shaft sunk to a depth of 45 feet. Seventeen veins had been discovered on the stripped surface, at the date of my visit, and it is reported that prospecting has uncovered a certain number of promising veins on the north east corner of Malartic township just south of the main workings.

We give hereafter the description of the work done on these vein individually:

Vein No. 1.—This vein has a length of 110 feet with an average width of 4 feet. At the western end the vein is 6 feet wide and it narrows down towards the east to 2½ feet. This vein has been partially trenched. The vein material is formed of quartz, feldspar and sericite, through which molybdenite is disseminated, and a little tourmaline.

Vein No. 2.—The length is 130 feet, the width averages 3 feet. Two rock excavations have been made, respectively 5 and 6 feet deep. The minerals are the same as those of vein No. 1.

Veins Nos. 4 and 4A.—These two veins have a parallel direction and can be followed over a distance of 350 feet. At the western end these veins are separated by a band of schist having a width of two feet, and this band widens to about 15 feet towards the east. Their width varies. Vein No. 4 is 2½ to 4 feet. Vein No. 4A has a constant width of about 5 feet. Towards the western end a shaft has been sunk to 45 feet on vein No. 4A. In the shaft the vein is 3 to 5 feet wide. At the bottom it is said to be 2½ feet. The shaft was full of water at the date of my visit. The sericite is abundant in the quartz and the molybdenite is fairly well disseminated through the sericite. Quartz and feldspar are also mineralyzed with molybdenite. Tourmaline is not abundant.

Vein No. 5.—Lenticular vein.—The hanging wall is granite and the foot wall is schist. A trench 60 ft. long has been made to uncover the vein, and a rock excavation 5 feet deep. The quartz is different from the other veins, being of a bluish black colour and vitreous. The sericite is abundant carrying disseminated molybdenite.

Vein No 2, of the Eureka Molybdenite mine, Lots 1 and 2, range 1
Township of LaCorne, Abitibi, Que.

Veins Nos 4 end 4A Eureka Molybdenite Mine, lots 1 and 2, range 1,
Township of LaCorne, Abitibi, Que.

Vein No. 5A.—This vein is cutting alternate bands of schist and granite. Length 80 feet, width 10 to 18 inches. The vein matter is pegmatite containing abundant sericite carrying much disseminated molybdenite. A trench 100 feet long was made to uncover the vein.

Vein No. 6.—Cutting alternate bands of schists and granite. The width varies from 8 inches to 5½ feet. The vein has a lenticular form, with its maximum width at the middle. The length uncovered by trenching is 200 feet. The vein carries much sericite with molybdenite, and very little tourmaline. Two rock excavations have been made each 5 feet deep.

Vein No. 7.—Cutting alternate bands of granite and grey schist carrying pyrite. Length uncovered by trenching 300 feet. Four rock excavations have been made having each an average depth of 5 feet. This vein contains large pockets of tourmaline towards its western end. At this end the vein bifurcates in two other veins having each one foot in width, separated by a band of schist two feet wide. The average width of the main vein is about two feet.

There exists two small outcroppings, north of vein No. 7, one has a width of three feet and the other 10 inches. These two outcroppings can be followed for a distance of about 50 feet each.

Vein No. 8.—Cutting alternate bands of schist and granite. Length 300 feet. Average width 18 inches. One rock excavation 5 feet deep. The vein is a pegmatite carrying tourmaline, sericite, molybdenite, and a little pyrite. The grey schist contains also a little pyrite.

Vein No. 9.—Cutting alternate bands of schist and granite. Length 200 feet. Average width 2½ feet with a minimum of one foot. One rock excavation 5 feet deep. The vein is a pegmatite carrying tourmaline, sericite and molybdenite. The sericite is present in the form of nests facing the schist bands only.

Vein No. 10.—This vein is formed of a series of parallel stringers cutting the granite. The vein is uncovered for a distance of 60 feet. The vein matter is a pegmatite containing a little tourmaline, sericite and molybdenite.

Vein No. 11.—This vein cuts the grey schists following the bedding planes. It consists of two parallel stringers. Average width 10 inches. The minerals are:—quartz, feldspar, fluorite, molybdenite, molybdite, with a few particles of tourmaline.

Vein *No. 14.*—Cutting the granite. Length uncovered 25 feet. Width varying from 1 to 5½ feet. Minerals present are:—quartz, feldspar, molybdenite and a little sericite.

Vein No. 16.—Cutting the schists towards the east and a dyke of quartz porphyry towards the west. Length 75 feet. Width varying from 6 to 15 inches. The minerals present are:—quartz, feldspar, tourmaline and molybdenite. The last mineral is more abundant where the vein cuts the porphyry dyke. A rock excavation 12 feet long, 4 feet wide, and 4 feet deep has been made. There is no sericite in the vein, as is the case in the other veins cutting the schists.

Vein No. 17.—Cutting the green and grey schists. Length uncovered by trenching is 75 feet. Its width varies from one inch to the east to 8 inches to the west. The vein pinches out towards the east. The minerals present are:—quartz, feldspar, a little tourmaline and molybdenite.

ZINC AND LEAD

During the year 1919 shipments of zinc and lead ores were made from the Notre Dame des Anges district only, in Portneuf county.

The production for the Province of Quebec amounted to 5,318 tons, made up of 2,432 tons of lead concentrates and 2,886 tons of zinc concentrates, the total value of which was $103,138.

This is a decrease of 2,320 tons of ore, and of $71,956 in value, as compared with 1918, when 7,639 tons valued at $175,094 was shipped.

The Quebec lead and zinc ore industry showed comparatively little activity during the year. *The Zinc Company, Ltd.*, whose mine is situated at Notre Dame, in the township of Montauban worked continuously throughout the year, but none of the other

properties in this district reopened. The *Federal Zinc and Lead Co. Ltd.*, who have been developing the promising deposits of zinc and lead ores in the region of the Cascapedia river, devoted most of their energy to road building during the year. The lack of means of communication has prevented a faster development of these promising occurrences, which are situated some 42 miles from the railway. The company is at present constructing a gravel road over this distance, for the purpose of doing the hauling by tractors. They contemplate the building of a large concentrator as soon as the road is finished.

Taking into consideration the increased cost of production, the average price of zinc for the whole year has been low, 7.3c. in New York and 7c. in St. Louis. In 1918, it had been nearly one cent higher. The extreme low price in 1919 was in May, 5.90c. and the highest in December, 8.90c. in New York. These prices may appear high as compared with the pre-war ones, when 5½c. was looked upon as a reasonable average. But under the present conditions the 7¼c. of the year would correspond to less than 4½c. under pre-war conditions. However, the difficult period seems to be over and the zinc market is constantly improving.

The lead industry passed through a critical period during the first part of the year, the price of the metal on the New York market declining to 4¾c. in May. However, during the last five months the situation greatly improved and the average price of lead for the year was 5¾c. At the end of the year it was 7½c. A common saying before the war was that "4c. is a good price for lead". This has now been replaced by "producing lead to sell it 7 cents in 1919, leaves less of a margin than did a 4c. market in 1914."

GOLD AND SILVER

As for the past five years the production of gold and silver in 1919 was derived from the treatment of the copper-sulphur ores of the Eastern Townships and the zinc-lead ores of Portneuf county. The gold recovered from these ores totalled 1,446 ounces, valued at $29,420, while the silver amounted to 127,223 ounces valued at $141,373.

The latest development work done in the Lake DeMontigny goldfield, 50 miles of Amos in the Abitibi district is given in Mr. Mailhiot's detailed report, further on in this volume, as a result of his field-work during the summer of 1919.

In the fall of 1918 and summer of 1919, reports circulated that very promising gold discoveries had been made in Gaboury township, south of Lac des Quinze, in the region east of Lake Temiscamingue. A short examination of the alleged occurrences was made in September 1919, by an officer of the Quebec Bureau of Mines.

As a result of the reports and rumours, quite an inrush of prospectors took place in that locality, and a great number of claims were staked. The area in question is situated in the unsurveyed, or southern half, of Gaboury township, which adjoins Latulipe township to the south. It is quite easy of access by canoe, the starting point being usually Gillies depot. The canoe route follows up the Fraser river, which is the discharge of two lakes, Des Bois and McKenzie. The scene of the rush was the southern end of lake Des Bois.

The country rock is here essentially dark green igneous rocks, showing frequently slight signs of schistosity, basalts, all of fine grained texture, basic volcanic rocks, probably of the Keewatin age, (Abitibi volcanics) cut and invaded by granites, often gneissoid in structure. The basic rocks are frequently seamed by quartz veins and lenses, in places slightly mineralized by specks of sulphides. It was these veins and lenses which attracted the attention of prospectors, and which were staked as mineral claims. This association of quartz veins which owe their origin to the last acidic stages of granite intrusions, penetrating Keewatin volcanics, is not promising from the economic standpoint. A search was made, by the writer, for porphyries, diorites or diabases of later age, the presence of which would have been a more hopeful features, but none were observed. Several samples were taken across veins, and silicified zones, and analyzed, but none of these showed more than a mere trace of gold. Since then, most of the claims have been allowed to lapse.

Gold has always been the most attractive of the metals to the prospector, and many of the deposits of the other metals have been discovered incidentally to the search for gold lodes. It is therefore unfortunate, for unprospected regions which yet hold out many possibilities, such as many districts in Northern Quebec, that during the last two years, gold deposits and gold mines have lost much of their lure, from the fact that the price of gold has remained stationary, being the standard of values, while the price of all other commodities, including labour and mine supplies, has soared beyond all that could be imagined a few years ago. Therefore, while the selling price of gold does not change, the cost of mining and extracting it has increased to the point that only the mines operating under particularly favourable conditions can work at a profit, and capital is very chary and fearful of investments in new gold ventures. Under such circumstances it is not to be wondered at that prospecting has not been active during the past two years.

MAGNESITE

The production of magnesite in the Province of Quebec during the year 1919 amounted to 9,940 tons valued at $283,719. Of this quantity 6,696 tons was dead-burned material, 1,656 tons was calcined magnesite, and 1,588 was shipped crude.

These figures represent a decrease, as compared with the previous year, when 21,349 tons of clinkered material was shipped, but this was expected owing to the decreased activities in metallurgy.

Three operators reported production, viz: The Scottish-Canadian Magnesite Co. Ltd., lot 15, range XI, township of Grenville; the North American Magnesite Co. Ltd., lot 15, range IX, Grenville, and the International Magnesite Co. Ltd., lot 13, range I, Harrington.

The *Scottish-Canadian Magnesite Co. Ltd.*, discontinued the clinkering of magnesite, in the Hull plant of the Canada Cement Company, towards the end of 1918, and all their shipments in 1919 were made from an accumulation of stock on hand. During the year just passed, all this company's energies were concentrated in improvements in their quarries and on the construction

of a sintering plant near the quarry, which, when completed will have an output of 3,000 tons a month of dead-burned magnesite. This will do away with the onerous freight charges of shipping the crude magnesite to the Hull cement plant, a haul of over seventy miles, and the new plant being designed specially for the burning of magnesite, it is expected that a saving of fuel will be effected. The consumption of coal at the Hull plant was 40 tons of coal for 100 tons of dead-burned magnesite.

The plant is expected to be complete and in running order in May 1920. In the main, it consists of a Gates crusher, which will break the magnesite to one inch size, two Krupp ball mills, which will reduce it to 20 mesh, and the final grinding to 90 or 100 mesh is to be done in three tube mills. The iron ore, to be mixed with it, is separately broken in a Gate's crusher, a Krupp mill and a tube mill. The mixture in the right proportions (3% of Fe^2O^3) will then be put through three horizontal revolving kilns, fired with powdered coal.

The coal will be passed through rolls, then dried, then passed through a Lehigh Fuller mill, to reduce it to 100 mesh. The capacity of the mill will be 70 tons a day of dead-burned magnesite, using only two tube-mills simultaneously; the third tube mill will be there as a spare.

The *North American Magnesite Co. Ltd.*, operated their quarry near Calumet, shipping most of the crude to the Longue Pointe plant of the Canada Cement Company, where it was dead-burned. The shipping was done over the narrow gauge railway of the Dominion Timber and Minerals, Limited, a company with interests in common with the Scottish-Canadian Company, to the main line of the C. P. R., thence to Longue Pointe, now a part of the city of Montreal. This, however, will soon be discontinued, for the company is now erecting a clinkering plant at Calumet itself, having acquired for that purpose the property of the old Graphite Company, who had built a large concentrating mill, a few hundred yards west of the C. P. R. station, and had not met with success. The new plant of the North American Magnesite Company is being built on the hill side, just below the old graphite mine. The intention is to begin operations with one rotary kiln, fired with

powdered coal, having a capacity of 40 tons of dead-burned magnesite per day.

The North American have at the quarry a kiln for the peoduction of caustic magnesite, which was operated during part of the year.

The *International Magnesite Co. Ltd.*, operates a quarry situated on the north ½ of lot 13, range I of Harrington, known as the Dobbie mine. Most of the magnesite quarried is calcined to caustic magnesite in a kiln similar to that erected at the North American quarry. The capacity of the kiln is 10 tons a day; it is drawn every two hours, and is fired with wood. The caustic magnesite is hauled 1½ miles to the plant of the Scottish-Canadian Magnesite Company, whence it is shipped by the narrow gauge railway, previously referred to.

The magnesite deposits of the Province of Quebec which are at present worked, are situated in the townships of Grenville and Harrington, county of Argenteuil, on the north side of the Ottawa river, half way between the cities of Montreal and Ottawa. The knowledge of their existence dates back to the year 1900 when specimens collected by Messrs, McAllister and Boshart were determined by the Geological Survey but it was only in 1907 that some work was done, on an outcrop of rock on lot 18, range XI of Grenville, and in that year some shipments of magnesite were made for trial. A small industry was created to supply material to manufacturers of flooring cements, and for the production of carbonic acid gas for aerated waters. Year by year the production increased, but it was a small industry until the cutting off of the source of supply of Austrian magnesite, by the European war, drew the attention of users of refractory materials to the Quebec deposits.

At first a strong prejudice existed against the Quebec magnesite, owing to its high contents in lime, and the lack of iron oxide which impaired its bonding qualities for furnace lining material. However, after experimentation to remedy these defects, a dead-burned magnesite is now manufactured from the Quebec magnesite which gives full satisfaction and has been declared by metallurgists who have used it, to be equal to the Austrian product.

By strict chemical control the lime is converted into silicates of lime and iron, which are neutral compounds which increase the power of resistance to corrosive agents, and an addition of finely powdered magnetite, intimately mixed before sintering, supplies the bonding qualities to the magnesite. There is no free lime in dead-burned Quebec magnesite, as now manufactured. In 1918 and 1919 important shipments of Canadian dead-burned magnesite were made to most of the steel mills of eastern United States and Canada, among which may be mentioned:—Bethlehem Steel Co., Carnegie Steel Co., Jones and Laughlin, Atlas Crucible Company, Halcomb Steel Company, Ludlum Steel Co., Algoma Steel Co., Steel Company of Canada, Dominion Steel Co., Nova-Scotia Steel and Coal Co., and the material has given eminent satisfaction.

War conditions caused deposits of magnesite to be developed in the Pacific States, of California and Washington, and operators of these deposits have been seeking protection of this industry by the imposition of a high tariff on all foreign magnesite entering the United States. This measure made the subject of Bill 5218, which passed the U. S. House of representatives on October 7th 1919; this provides a duty of ½c. per lb. on crude magnesite; ¾c. per lb. on dead-burned, calcined and grain magnesite, and ¾c. per lb. plus 10% *ad valorem* on magnesite brick. At the end of the year the bill had reached the stage of having been placed on the Senate calendar, but had not yet been passed by that body.

There is no doubt that should the measure become law it will have a very detrimental effect on the Quebec magnesite industry. An extra tax of $15 a ton on material now quoted $45 a ton will tend to greatly decrease the exports to the United States.

GRAPHITE

The year 1919 was one of inactivity for the graphite industry of Quebec as regards production, but some experimentation and alteration of mill practice were carried on in the Buckingham district, and in Amherst township.

The only shipments recorded this year consisted in a few tons of low grade material shipped to England for experimental purposes, on which a nominal value has been placed.

The *Consolidated Graphite Company* (Peerless Company's plant), on lot 14, range X of Buckingham township, put in a Callow plant in the spring of 1919, consisting of two roughers and two cleaners. The old mine on lot 12, range IX, was reopened, but apparently the results were not satisfactory, for mining work was abandoned, and for some time the mill was running on recovering the graphite contents of old crucibles, bought in Montreal and Lachine from steel mills and rolling mills. The crucibles were treated like ore, and the results of the Callow cells are said to have been very satisfactory.

Some prospecting work was carried on by *Graphite Products, Ltd.*, on their property, lot 16, range VI of Amherst township. This company acquired this property in 1918 after the liquidation of the previous owners, Graphite Limited. The new company, Graphite Products, also went into liquidation towards the end of the year 1919, but a reorganization at an early date was contemplated.

On this property a shaft has been sunk, said to be about 100 feet deep, but this has been full of water for some time. The main working consists of a tunnel into the side of a hill, the entrance of which is below the collar of the shaft. This tunnel, which is connected underground with the shaft, after taking a sharp turn comes out again in the side of the hill. It has cut through several lenses or pockets of graphite ore, showing large flakes in a gangue of calcite, wollastonite, and pyroxene. Open-cut workings are situated immediately to the north of the shaft. These are of more recent date than the shaft and tunnel. The opening or cut, in the side of the hill is 90 feet long by 30 feet into the hill. From the face two short prospecting tunnels have been driven, ten feet and twenty-two feet respectively. Samples of ore taken from the tunnels, and from the east side of the open cast pit by Mr. Dufresne, the Assistant Superintendent of Mines, who visited the property in September, gave contents varying between 7.60 and 9.20% of graphite. The ore from the open cast workings was hauled to the concentrating mill by a narrow gauge track. On the whole the development work done on this property shows some rich pockets of coarsely crystalline graphite, in bands of calcareous rocks, and there are indications of possibilities of the

presence of considerable tonnage of ore. But much more development work is needed to ascertain this and block out ore, to ensure feeding the mill. The concentrating plant consists of a large three storey building, a crushing plant and a drying kiln. The crusher house contains two Austin crushers, an elevator to a bin feeding a ball-mill, 3x6 feet; and a launder taking the pulverized ore to an elevator in the main building. The process used in the past for concentration was a dry process, on the principle of silk screens, but at the time of Mr. Dufresne's visit, this was being altered and a Spearman concentrator was being put in. Coal oil is to be added to the ore in the ball mill and the flakes are to be floated off by a device in which water and air are added to form bubbles. The graphite then goes to a rotary dryer, 12 feet long, 9 inches in diameter, heated by a coal furnace, and on coming out it is sized in cloth screens. The power plant is well equipped with two Goldie-McCollough boilers, one Ideal steam engine coupled to a dynamo; one Jerome Wheelock engine for the mill; and a six drill air compressor.

The graphite industry was very inactive in the whole of North America during the year 1919. As 75 to 80% of the graphite consumption is in the manufacture of crucibles for steel making, it is natural that the reaction from war conditions to peace conditions, which deeply affected the steel industry, should have also affected the production and the consumption of graphite. At present the graphite producers of the United States are seeking some relief by means of a bill which provides a tariff on graphite imported into the United States, as follows:—

"(1) Crude graphite ores, under 50 per cent in graphitic carbon, 1c. per pound.

"(2) Graphite ores, over 50 per cent in graphitic carbon, 2c. a pound.

"(3) Lump and chip graphite coarser than 1-4 inch, 3c. per pound.

"(4) Flake, concentrates and refined flakes, finer than 1-4 inch, 6c. per pound.

"(5) Manufactures of graphite, 5c. per pound of graphite contained.

Concentration of Graphite."

In an article published in the *Canadian Chemical Journal* (1) Mr. Spence reviews the Canadian graphite situation, and regarding the application of flotation processes to the concentration of this mineral, he says: "Of all the processes for refining flake graphite, "that have received a trial in actual practice, that of oil flotation "has probably given the best results. Several systems of oil "flotation have been patented, the basic principles being the same "in all cases, and the difference between them lying in the method "of producing the froth necessary to float the mineral particles. "The Callow, Mineral Separation, and Simplex systems have all "been installed in the Alabama field, and the largest mill in New "York state has lately also been equipped with the Callow system. "A number of parcels of graphite ore have been cleaned at the Ore-"Testing Laboratory of the Mines Branch, at Ottawa, by means "of the Callow pneumatic machine and the results obtained show "that oil flotation is admirably adapted to Canadian graphite "ores.

"The percentage of recovery was 76.41 and the average carbon "content of the different sizes of product 89.6 per cent.

"Sufficient experimental work has now been done with frothing "oil flotation to demonstrate that the process offers probably the "cheapest and most efficient means of producing high grade graphite "concentrates that has yet been devised. As with any other "method, adaptation of the process to the particular ore to be "treated is essential for best results, and certain ores may be treated "with greater facility and better results than others. The fact, "however, that flotation has given good results on graphite ores "from Alabama, New York and on various types of Canadian ores, "shows that with adequate care, the process is adaptable to gra-"phite ores in general.

"One of the important questions in connection with the milling "of flake graphite ores is that of the most suitable methods of "freeing the flakes of attached gangue. Since it is of paramount "importance that the natural size of the flakes be preserved as

(1) *Canadian Chemical Journal*, July 1919, page 213.

"far as possible, consistent with clean separation, it is essential "for maximum efficiency that the flakes be removed from the action "of the grinding machine as soon as they are freed. A great "variety of grinding machines are in use, including stamps, ball "or tube-mills, rolls, chasers, etc. Much depends on the nature "of the ore as to the type of grinder to be employed, some ores "being weathered and friable, as, for example, those of Alabama "and Pennsylvania, while others are relatively hard and difficult "to break, as in the case with the New York and certain Bucking- "ham (Quebec) types. Some ones are gneissic in character and "may be quite siliceous, while others, are represented by graphitic "crystalline limestones. For the above reasons, one type of grinder "may obviously be better adapted to the ore of a particular district "than another.

"The grinder probably in highest favor at the present time for "hard gneissic ores, such as are found in the Buckingham district, "Quebec, is the ball or pebble-mill, grinding being wet, this per- "mitting the flakes to float as soon as freed and removing it from "the action of the machine. Employing oil flotation, the oil may "conveniently be added to the charge in the mill, thus grinding the "ore and emulsifying the pulp in the one operation.

"Wet grinding by any type of machine is far preferable to "dry grinding, owing to the great amount of dust produced by the "latter method. Much fine dirt adheres to the flake made in "dry grinding and passes over with it, while in wet grinding the "tendency is rather to wash the flake free of such dirt. It is also "claimed from microscopical examination of the flake made by the "two methods that the original flake form of wet-ground graphite "is preserved far better than that of dry-ground.

"While it has been definitely established that oil flotation "offers a ready means of producing refined graphite from its ores, "the important question remains whether the refining can be made "profitable. A flotation plant has the merit of being relatively "cheap both to install and to operate as compared with many of "the processes heretofore employed. Preliminary drying of the "ore is dispensed with, power consumption is lower and fewer men "are required for running the mill than is the case with most of

"the other methods. Better extraction is also possible, a percentage "of recovery of 75 being readily obtained: with manipulation, this "can in many cases be raised to 90 or better. Few of the methods "in previous practice have averaged much over 50 to 60 per cent "recovery. With oil flotation, therefore, the number of pounds "of flake recoverable per ton of ore treated is greater, and the "cost of production per pound is as low, if not lower, than by "almost any other method.

"Cost estimates for a mill treating 100 tons of Alabama "graphite ore per day by oil flotation show that mining and milling "costs amount to about $2.25 per ton of ore treated. This ore "carries only three per cent of graphite, of which about 2½ per "cent is figured as recovered; so that each ton of ore would yield "50 pounds of graphite of all grades, at a cost of nearly 5 cents per "pound. Electric power is available in this district, the power "consumption being figured at 150 H.P., and the cost at 37½ cents "per ton of ore treated. Mining costs are considerably lower than "would be the case in Canada, since the ore is soft and quarry "methods can be employed. On the other hand, the better grades "of Canadian ore carry four to five times as much graphite and the "flake is larger, so that the yield of No. 1 flake per ton of ore would "be very much higher.

"It should be borne in mind that the successful operation of "a graphite mill must depend essentially upon the output of the "No. 1 size (20 to 90 mesh) flake, the smaller mesh sizes being "merely accessory. The market for the No. 2 and, more especially, "the dust grade, is a very fluctuating one, and there is often dif- "ficulty in dispo-ing of these products at any price. If, therefore, "profits cannot be made on the output of No. 1 flake, it is bad "policy to figure on covering the margin by the No. 2 and dust "grades.

"The question of whether Canadian flake graphite can be "produced at a profit is one that depends so largely upon foreign "supplies that it is difficult at the present juncture to hazard an "opinion. The crucible trade is estimated to consume in the "neighborhood of 75% of the world's total graphite production, "and this industry is supplied, at any rate, in the Allied countries,

"mainly from Ceylon and Madagascar. Each of these countries "has an annual output of between 30,000 and 40,000 tons of gra- "phite, the bulk of which goes to Great Britain, France and the "United States. While the price of crucible graphite rose to an "unprecendented level during 1917 and 1918, Ceylon plumbago "going as high as 30 cents per pound ex-dock in New York, and No. "1 flake selling at 16 cents per pound, this state of affairs has now "changed materially. Removal of war risk insurance and reduc- "tion in freight rates has brought the price down very considerably, "and while the pre-war level is unlikely to be reached, owing to 'the general rise in price of commodities all over the world, there "is every probability that prices will go still lower than they are "at present. Latest quotations for Ceylon plumbago and flake "graphite on the New York market (July 1919) are as follows:—

Ceylon Plumbago

No. 1.—Lump	13 to 13½	cents per pound
No. 1.—Chip	10½ to 11	cents per pound
No. 1.—Dust	7½ to 8½	cents per pound

Domestic Flake Graphite

No. 1	9	cents per pound
No. 2	3	cents per pound
Dust	1½	cents per pound

"The opinion has been expressed to the writer by prominent "New York graphite importers, that in order to meet foreign com- "petition when trade conditions return to normal, Canadian (and "American) No. 1 flake graphite will have to be produced at a figure "not exceeding 5 to 6 cents per pound.

"Another factor that affects the situation is the growing "tendency in the metallurgical industries to introduce electric "furnaces for melting steel and alloys. The number of such fur- "naçes in the United States has increased greatly in the past few "years, with consequent diminution in the quantity of crucibles "used.

"*Uses of Graphite.*—With the growing demand for graphite "products, probably one of the best opportunities for profitable

"operations lies in the manufacture of such products by the refiner "of graphite, as, in this way, all of the grades made can be utilized "on the spot. Much of the natural graphite consumed in this "country goes into foundry facings, lubricants, paints and stove "polish, all articles that require no excessively costly equipment "to manufacture and on which far greater profits might be realized "than on the graphite entering into them as a raw material.

"The paint trade uses both artificial and imported amorphous "graphite.

"Both flake and amorphous graphite is employed in lubricants. "In addition, the Acheson Oilday Company, at Sarnia, Ont., "manufactures so-called "de-flocculated graphite" a very finely "divided artificial graphite for use in their lubricating compound."

Flotation at Ticonderoga.—The graphite concentration plant of the Dixon Crucible Company, at Ticonderoga, in the state of New York, which treats ore that greatly resembles the Quebec ores of graphite, was remodelled in 1918, introducing Callow cells for the treatment of graphite ore and as the process has now been proved a success by a year's operation, it is interesting to reproduce a part of an article which appeared in the *Mining and Scientific Press* (1).

"The ore next is fed to the ball-mill by means of a 16-in. "combined feeder and conveyor. The first grinding, to 28-mesh, "is in a 6 ft. by 22-in. Hardinge ball-mill operated in closed "circuit with a standard duplex Dorr classifier. A heavy cir- "culating load is carried in order to separate the graphite in as "coarse condition as possible. The flotation oils, fed to the ball- "mill increase the surface tension of the pool in the classifier, this "allowing the coarse flakes to overflow the classifier, if they reach "the surface, even though they may be coarser than 28-mesh. "Lately, it has been found advantageous to send the ball-mill "product to two Deister cone-baffle classifiers and treat the spigot "products of these in the Dorr. The overflow products from "both classifiers combine to supply the flotation plant.

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(1) *Mining and Scientific Press*, April 17th, 1920.

"The flotation machines are standard Callow pneumatic cells, "arranged somewhat differently from ordinary practice. Four cells "are used as roughers and make a final tailing, and a concentrate "that is sent to two primary cleaner-cells. The primary tailing is "returned to the rougher-cells by means of a bucket-elevator, while "the concentrate at this point is screened on 100-mesh. The "oversize goes to a 5 ft. by 22-in. Hardinge pebble-mill, and the "undersize, combining with the pebble-mill discharge, is re-floated "in the first and second re-cleaner cells. The concentrate from "the second re-cleaner is screened on 100-mesh; the oversize goes "to a second Hardinge mill, and the undersize, combining with the "pebble-mill discharge, is re-floated in the third and fourth re-"cleaners. All the cleaner tailings are returned to the flotation-"circuit. The final concentrate is obtained from the fourth re-"cleaner and is run into settling-tanks where it drains for eight "hours. These tanks have one side made of canvas in order to "help the draining. From the tanks the concentrate, containing "about 40% moisture, is shoveled by hand into a screw-conveyor "that discharges into a revolving dryer, from which it is elevated "into a storage bin. The finer sizes of concentrate as well as the "purer flakes of graphite, which would otherwise go up the stack, "are recovered in dust-collectors. Three grades of product result.

"The sides of all the cleaners are raised about 12 in. and three "wooden baffles are placed across the cells at equal intervals. "The baffle nearest the discharge is level with the top of the original "side; the next baffle is about three inches higher, and the third "three inches higher than the second. This divides the cell into "four compartments and the concentrate, in flowing from one "compartment to the next, forms a small cascade over each baffle. "The concentrate is taken from the end of the cells instead of "from the sides, so that in the froth zone, it must travel in full "length of the cell (8 or 9 ft.) before being discharged. This "arrangement of baffles is effective in producing a high grade con-"centrate.

"Several features somewhat out of the ordinary are found in "the plant. Graphite, being a lubricant, caused some difficulty "in the crushing and grinding operations; high-grade pieces of ore "were particularly troublesome. Accordingly the head and con-

"caves of the crusher are made with slight longitudinal corru-
"gations that serve to force the lumps of ore downward as the shaft
"turns. Although the feed to the 30 by 14-in. rolls had passed a
"one-inch screen it was found that the rolls would not nip occa-
"sional pieces of high-grade ore. Accordingly in the outside of
"each shell, eight sets of four 1½in. diam. holes were drilled almost
"through the metal. This overcame the difficulty effectively.
"Similar difficulty in the ball-mill was overcome by increasing the
"speed of the mill. The 100-mesh revolving screens were made at
"the plant out of silk instead of metal cloth. Silk lasts longer
"than wire in this particular service.

"The mill operates 24 hours per day, six days per week, and
"the average actual tonnage is slightly more than 100 tons per
"day. The mill-heads average 5½% graphitic carbon and the
"total concentrate by months averages 86½%, while the coarse
"concentrate averages 91%. The present output of the mill is
"about 530,000 lb. of concentrate per month. The average actual
"recovery for 1919 was slightly more than 87%.

"The mill and the compressors are driven by steam. A
"direct-current generator supplies power for the electric locomotives
"and for lights. Anthracite coal is used in the boiler-plant.

"The dried concentrate is bagged at the concentrator and
"hauled to the refinery at Ticonderoga by team and truck. The
"three grades are kept separate, as the higher grades require less
"grinding. The refinery process consists simply in further grinding
"and screening. The grinding is done dry in cylindrical mills using
"small steel balls. A charge of concentrate is run into one of these
"mills and ground just long enough to free the graphite flakes from
"any small particles which may adhere to them. The concentrate
"from the dust-collectors at the concentrator is higher-grade and
"is ground for only a few minutes, while the lower-grade concen-
"trate from the drier requires a longer period. After being ground,
"the material is screened in gyrating sifters similar to those used
"in flour mills, the coarser sizes being higher-grade. From the
"refinery the graphite is shipped in barrels to the Joseph Dixon
"crucible-plant in Jersey City, where it is used in the manufacture
"of a variety of products."

MICA

The year has been favourable for the mica industry and the production of the Province of Quebec amounted to 3,853,265 lb. valued at $224,988. As compared with 1918 it is an increase in value of 11%. As to the quantities it is very difficult to establish comparisons from year to year, for the nature of the products varies from scrap mica, quoted $10. a ton and less, which is used to make pulverized mica, to clear large sheets of trimmed mica 4x6 which sell for $2.00 a lb. and extra large sizes for special uses may even bring $4. or $5. a lb.

Operators of mica mines put this mineral on the market in different forms, the principal ones being rough-culled mica, thumb-trimmed mica, thin-split mica, and scrap mica. The latter is further prepared, mainly in the manufacture of pulverized mica of different sizes up to 200 mesh, but no pulverizing mills are operating in the Province of Quebec. Several of the mine owners, however, have trimming and splitting shops, where they prepare the product of their mines, and in the reports received from the producers, by the Quebec Bureau of Mines, it is frequently difficult to differentiate the various forms and qualities. Hence the necessity of aggregating the quantities into one whole, which, however, renders general statistics of mica rather unsatisfactory.

An attempt to classify the total production of 1919 gave the following results:—Thumb-trimmed mica, 541,905 lb. valued at $133,645 or 24.7c. a lb.; rough-culled mica, 48,000 lb. valued at $2,400 or 5c. a lb.; thin-split mica, a large proportion being sizes 1x1 and 1x2 for the manufacture of micanite sheets, 146,360 lb. valued at $79,876 or 54.6c. a lb.; the balance some three million pounds being scrap, valued $9,057 or $5.80 a ton of 2,000 lb.

Prices for mica were satisfactory and well sustained throughout the year, as follows:—

1x1 inches	8 to 15c.	2x4 inches	70 to 90c.
1x2 "	13 to 20c.	3x5 "	1..00 to 2..00
1x3 "	18 to 30c.	4x6 "	1..75 to 2..50
2x3 "	38 to 60c.	5x8 "	2..00 to 3..00

The larger proportion of the Canadian mica production comes from the Province of Quebec, from the district north of Ottawa river, comprising the basins of the Gatineau and the Lièvre rivers. The preliminary statement of the mineral statistics of Canada gives the Canadian production of mica for the year 1919 as valued at $273,305. The mica produced in Quebec would therefore represent a little over 82% of the total.

MINERAL PAINTS

Iron Oxide and Ochre

The production of iron oxide and ochre in 1919 amounted to 11,937 tons valued at $111,645. As compared with the previous year, this is a decrease of 30 per cent in quantity and of less than one half of one per cent in value; the higher prices obtaining during the year practically made up for a comparatively large decrease in tonnage.

Both calcined oxide for paint manufacture, of an average value of $34.50 a ton, and natural raw oxide used for coal gas purification, valued at $3.04 a ton, contributed to the production.

Returns were received from the following producers:—

Thos. H. Argall, Three-Rivers, P. Q.

Canada Paint Company, Ltd., Red Mill, P. Q.

Champlain Oxide Company, Three Rivers, P. Q.

Paint Products Company of Canada, l'Ascension, P. Q.

Most of the production comes from the deposits of Cap de la Madeleine, and the largest producer of calcined oxide, is the *Canada Paint Company* who have a very complete plant at Red Mill, six miles east of Three Rivers. During 1919, important improvements were introduced in this plant. Previously, the raw material, as it came from the bog, was placed on the upper surface of the calcining kiln for drying, and it was kept rabbled by workmen. This process was slow and costly in labour, and as the company wanted to considerably increase the output of calcined oxide, a mechanical

dryer was erected. This is a revolving cylinder, 40 feet long, 4 feet in diameter. The reverbatory kilns are now used exclusively for calcining the dry material, and as this now reaches them dry, their capacity of output is practically doubled.

The *Paint Products Company, Ltd.*, report that they produced a very appreciable quantity of calcined ground ochre, or rather oxide, which has been very favourably received, both as colours and degree of fineness. However the cost of production has been very high, and improvements are contemplated before resuming operations in the spring of 1920. As it now is constituted, the plant, apart from the necessary excavating machinery on the bog and the hauling installation, comprises a rotary dryer, three rectangular kilns for calcination, three sets of millstones for the grinding. The capacity of output is six to eight tons a day, of finished material, the greater part of which goes through a 200 mesh screen, and which on analysis gives 90 to 95% of iron oxide.

SILICA AND QUARTZ

The production of silica and vein quartz during the year 1919 amounted to 15,055 tons, valued at $50,161. This is a decrease as compared with the previous year, and this was expected. In 1918, much silica was used in the manufacture of ferro-silicon for the generation of hydrogen, for inflating observation balloons, dirigibles, and "lighter than air" crafts. Therefore with the end of the war the use of this material practically ceased, and moreover hydrogen is now in a large measure replaced by helium gas. The latter is not combustible and its use diminishes greatly the dangers of aerostation.

The sources of silica in the Province of Quebec are sandstone, quartzites, quartz veins, and pure sand washed out of kaolin. In 1919 these materials were used for the manufacture of ferro-silicons, of abrasives made in the electric furnace, glass making, and flux in the manufacture of certain electric furnace products, such as phosphorus.

In our report for 1918, the various localities in the Province of Quebec, where such materials can be obtained, were reviewed at length, and anyone interested in the matter is referred to it.

The *Cascades Silica Products Company*, have abandoned their Cascades quarry at the lower end of the Soulanges Canal. The crushing and washing plant which they had at this place, has been dismantled and transported to their new quarry at St. Canut, where it was operated for two months, the silica being shipped to Shawinigan Falls for ferro-silicon. The demand for this product diminishing greatly, the operation of the quarry and of the washing plant was discontinued. After this, the energies of the operators were concentrated on the improvement, and practically the reconstruction of the mill, at St. Canut, installing machinery to crush, wash, screen and dry the sand produced from the sandstone, so as to turn out a product to be used in the manufacture of glass and of carborundum, for both of which an exceptionally pure sand is required. At the end of the year the installation of the mill, was not yet completed.

The *Montreal Sand and Gravel Company, Ltd.*, operated their Melocheville quarry and crushing plant for six months, producing sand, which was used in a large measure, in the manufacture of common glass.

The vein quartz, which is mined in the Buckingham district was employed partly in the manufacture of abrasives, and partly in the manufacture of ferro-silicon, while some of it was used as flux in the manufacture of phosphorus.

For the manufacture of abrasives in the electric furnace, such as manufactured by the Canadian Carborundum Company, at Shawinigan Falls, the requirements are very high as regards the raw material. The sand must run 99½% or more of pure silica, and the only such material so far found in the Province of Quebec, is some parts of the St. Canut outcrops of Potsdam sandstone, which yield remarkably high grade sand.

As to sand for the manufacture of glass, the requirements vary according to the quality of the glass made. We here reproduce a summary of such requirements, from the Official Report of the United States Geological Survey "Mineral Resources 1916".

"The factors which determine the value of a deposit for "making glass are chemical purity, physical character, quarrying

"conditions, and location with respect to transportation, cheap "fuel and market.

"Glass is a transparent impermeable substance formed by "fusing sand, or silica, with fixed alkalies. It is made by melting "the ingredients in a pot or tank, mixing the batch thoroughly, "and allowing it to cool. It is molded into the desired form while "molten. Sand is the principal constituent of all glass, com- "prising from 52 to 65 per cent of the mass of the original mixture. "The qualities of the glass, such as lack of colour, brilliance, trans- "parency, and hardness, depend largely, therefore, on the quality "of the sand.

"For the finest ware only the purest quartz (silica) sand can "be employed because slight impurity, especially a small quantity "of iron, impairs the brilliance, whiteness and clearness. Thus "for the manufacture of glass for optical instruments, which is "practically colorless, sand, or ground silica, should contain not "more than 0.015 per cent of ferric oxide. Plate and window "glass are commonly pale green and absolute purity is not essential "in the sand, but more than 0.2 per cent of ferric oxide is undesir- "able. Green and amber glass for rough structural work, as "skylights, sidewalk lights, for bottles, jars, and insulators, are "made from sand that has more impurity than is permissible in "sand for plate glass and prescription ware.

"The suitability of a sand for making glass may be determined "roughly by inspecting it for the following properties: the sand "should consist almost entirely of quartz, or silica, (most glass "sands contain from 98 to more than 99 per cent of silica), it "should be nearly white or easily washed white; the grains should "be uniform in size, either angular or rounded, and preferably "should not be larger than 20 mesh nor smaller than 80 mesh. "Whiteness is not essential, however, in sand for ordinary window "glass and cheap bottles and jars. Sand for window glass that "has been dug at a New York locality for many years is pink or "dark flesh-coloured, and an Indiana sand used for making beer "bottles is drab, because of a coating of clay on each of the color- "less quartz grains.

"Most of the glass sand produced in this country is obtained

"by crushing soft, crumbly sandstones, but where power is very "cheap, it is practicable to produce glass sand by crushing quartzite "and vein quartz.

"Methods of quarrying and preparing the sand vary some- "what but in general the quarry face is drilled, and shot down "with an explosive, and the coarse and fine material is delivered "to the mill. If a special quality of sand is desired, selection may "be made at the quarry by hand sorting. Large lumps, if very "hard, are reduced by a jaw or rotary crusher, but in most places "by a less powerful machine, such as a pug-mill or muller or a "crusher consisting of many heavy hammers revolving rapidly.

"Washing the crushed sand is done by two common methods. "By one method the sand is carried first upward by a screw con- "veyor through a long, narrow inclined box against a descending "stream of water and then downward in a narrow chute by a second "stream of water. This process is repeated three or four times, "after which the sand is spilled on a belt conveyor and carried to "the draining piles. Another method of washing is by settling "tanks. A stream of sand and water is discharged into a tank "where the sand settles and impurities are drained off. Sand "washed by this method may be left in the last tank to drain, or "it may be carried to a draining pile. Sand carried away by the "wash water in either process is caught in settling ponds or yards "outside the mill and may be used for the various purposes to "which a fine-grained silica sand is adapted.

"After draining for several hours, or days, the sand is dried, "either rapidly in rotary cylindrical driers heated by gases from "coke or other smokeless fuel, or slowly by settling through coils "of steam pipes, and is then screened and put in stock bins. Glass "sand is shipped in box cars, which are lined with paper to prevent "leakage."

PEAT

For the first time in many years we record in our table a production of peat. Strictly speaking, peat is not a mineral, being an early stage of the conversion of vegetable matter into a fossil fuel, but it is customary to include this product in the mineral statistics.

The producers are the "Tourbières des Laurentides" with head office at Grand'Mère, who operated on the Garneau Junction bog, the peat being delivered at Grand'Mère by auto-truck, a haul of four miles, for domestic use.

The method of working is primitive. The peat is dug up by spades, in blocks 12″x12′; these are allowed to drain or dry on the ground for a few days, and are then taken to the cutting shed where they are cut into nine pieces or bricks. These are then stacked for drying, on racks similar to those used in brick yards.

The bog which is being worked is an extensive one, covering some 500 acres in area, with a depth of peat varying from 5 to 11 feet.

STRUCTURAL MATERIALS

The value of structural materials is an important item in the mineral production of the province. In 1919, it amounted to $8,090,241, an increase of $2,749,254 or 51.5 per cent as compared with the previous year, when it was $5,340,987.

The increase is to a certain extent to be attributed to the higher cost of production. As an instance, brick in 1918 was reported at an average of $9.41 a thousand, while for 1919 it was $12.50.

The quantities of cement, lime, limestone and brick produced show considerable increase as compared with 1918, and this increase would have been larger, had the building operations been commensurate with the needs, The situation in urban centers, as regards dwellings to keep up with the increase in population, is becoming acute. That building activities have not been much greater in 1919 than was the case, was due to the scarcity and the exigencies of labour, which rendered construction abnormally costly. But whether or not there is an improvement in that respect in 1920, there will be many more buildings erected in 1920 than in 1919, and a consequent higher production of building materials.

The Province of Quebec is particularly well favoured as regards building materials. It possesses an abundant supply of building

stones, such as limestones, granites of various colours, sandstone; raw materials for the manufacture of cement; marbles for ornamental uses; slates of excellent quality for roofing; immense and numerous deposits of alluvial clays for the manufacture of common brick, and shales for pressed brick; sand-pits.

The building stones of Quebec have been well described in a large report "Building Stones of Quebec", published by the Mines Branch of the Canadian Department of Mines, Ottawa, and the clay deposits in a report "Clay and Shales of Quebec", published by the Canadian Geological Survey, Ottawa, and the public interested in these subjects is referred to these volumes.

LIST OF THE PRINCIPAL OPERATORS AND OWNERS OF MINES AND QUARRIES IN THE PROVINCE OF QUEBEC

ASBESTOS

Asbestos Corporation of Canada Limited,
J. McCallum, Secretary, Thetford Mines, Que.

Asbestos Fibre Mining Co.,
East Broughton, Que.

Beaudoin, P. E.,
Thetford Mines, Que.

Bell Asbestos Mines,
Hon. Geo. R. Smith, Vice-Pres. and Mgr., Thetford Mines, Que.

Bennett-Martin Asbestos and Chrome Mines, Limited,
Thetford Mines, Que.

Black Lake Asbestos and Chrome Co., Limited,
Black Lake, Que.

Blais and Fillion,
Thetford Mines, Que.

Canada Asbestos and Chrome Co.,
Coleraine, Que.

Canadian Johns-Manville Co., Limited,
Asbestos, Que.

Consolidated Asbestos Ltd.,
N. Fisher, Mgr., Thetford Mines, Que.

Federal Asbestos Company,
Robertsonville, Que.

The Frontenac Asbestos Mining Co.,
F. W. Ross, Mgr., 92 St. Peter Street, Quebec City.

W. Jacobsen,
Black Lake, Que.

Johnson's Co.,
A. S. Johnson, Mgr., Thetford Mines, Que.

The Pennington Asbestos Co.,
Thetford Mines, Quebec.

Jos. Poulin,
East Broughton, Que.

Quebec Asbestos Corporation,
E. E. Spafford, Mgr., East Broughton, Que.

Windsor Asbestos Mining Company Limited,
Coleraine, Que.

CHROME

J. V. Belanger Mining Co., Ltd.,
Black Lake Que.

Black Lake Asbestos & Chrome Co., Limited,
Black Lake, Que.

C. L. Campbell,
602 Royal Trust Bldg., Montreal.

Dominion Mines & Quarries Limited,
Dominion Bank Building, Toronto, Ont.

J. D. Kennedy,
Sherbrooke, Que.

Mutual Chemical Company of Canada, Limited,
Black Lake, Que.

Quebec Asbestos & Chrome Co.,
Douglas B. Sterrett, Manager, St. Cyr, Richmond Co., Que.

Victory Chrome Mines, Ltd.,
103 St. François Xavier, Montreal.

COPPER

Eastern Mining & Milling Co., Limited,
Bk. of Hamilton Bldg., Toronto, Ont.

Eustis Mining Company,
F. M. Passow, Manager, Eustis, Que.

Glenama Mining Co.,
Minikek, Bonaventure Co., Que.

Dr. E. G. Henry,
Lennoxville, Que.

Maytor Hoppenyan,
Eastman, Que.

The Norton Mining Co.,
Coaticook, Que.

Weedon Mining Co., Limited,
L. D. Adams, Pres., 609 Eastern Townships Bank Bldg., Montreal, Que

FELDSPAR

British Magnesite Corporation,
605 McGill Bldg., Montreal.

Bush Winning,
N.-D. de la Salette, Que.

Edward Watts,
19 Chesnut Park, Toronto, Ont.

Eureka Flint and Spar Co.
Trenton, N. J.

GOLD

Eustis Mining Co.,
F. M. Passow, Manager, Eustis, Que.

Martin Gold Mining Co.,
Amos, Que.
Siscoe Mining Syndicate,
Amos, Que.

Joseph F. Stabell,
1127 Niagara St., Buffalo, N. Y.

Zinc Company, Limited,
Room 605, Eastern Townships Bank Bldg., Montreal.

GRAPHITE

Bell Graphite Co., Limited,
Box 185, Buckingham, Que.

The Canadian Graphite Co.,
T. W. P. Patterson, Manager, Room 223, Coristine Bldg.,Montreal, Que.

Consolidated Graphite Mining & Milling Co.,
Buckingham, Que.

Graphite Products, Limited,
189 St. James St., Montreal.

Quebec Graphite Co., Limited,
R. C. Rowe & C. N. Daly, Managers, Buckingham, Que.

Plumbago Syndicate,
Excelsior Life Bldg., Toronto.

IRON & TITANIC IRON

American Titanic Iron Co.,
c-o Hon. S. N. Parent, Parliament Bldg., Quebec City.

Baie St. Paul Titanic Iron Ore Co.,
J. O. Paré, Manager, Baie St. Paul, Charlevoix Co., Que.

The Loughborough Mining Co., Limited,
Sydenham, Ont.

Manitou Iron Mining Co.,
Jos. E. Globensky, 364 University Street, Montreal.

Superior Iron Co.,
7 Clemow Ave., Ottawa.

KAOLIN

The Canadian China Clay Co., Limited,
Huberdeau, Que.

MAGNESITE

International Magnesite Co.,
1055 Eastern Townships Bank Bldg., Montreal.

North American Magnesite Co.,
Room 127, Board of Trade Bldg., Montreal.

Scottish-Canadian Magnesite Co., Reg'd,
Bank of Toronto Bldg., Montreal.

MICA

W. Ahearn, Jr.,
538 MacLaren St., Ottawa.

Wm. Argall,
Laurel, Que.

Blackburn Brothers,
Union Bank Bldg., Ottawa.

Calumet Mica Co.,
Campbell's Bay, P. Q.

Capital Mica Co., Limited,
W. Ahearn, Manager, St. Pierre de Wakefield, Que.

Chabot & Co.,
124 Rideau St., Ottawa.

Cross & Wilson,
Cascades, Hull, Que.

Joshua Ellard,
Wright, Que.

James A. Fleet,
Buckingham, Que.

H. T. Flynn,
106 Montcalm Street, Hull, Que.

J. B. Gauthier,
Box 226, Buckingham, Que.

J. B. Gorman,
Box 166, Buckingham, Que.

Wm. Gowan,
Holland Mills, Que.

John E. Hardman,
East Templeton, Que.

Sylvio Lafortune Mining Co.,
Pointe Gatineau, Que.

The Loughborough Mining Co.,
N. J. Sproule, Manager, c-o G. W. McNaughton, Sydenham, Ont.

Alex. MacLaurin,
522 Board of Trade Bldg., Montreal.

A. Roy McConnell Consolidated Mines, Ltd.,
1558 Yonge St., Toronto, Ont.

McGlasham & Son,
Glenlivet, Que.

A. Nault,
Maniwaki, P. Q.

O'Brien & Fowler,
703 Hope Bldg., Ottawa.

W. L. Parker,
Buckingham, Labelle Co., Que.

Wallingford Bros.,
Banque Nationale Bldg., Ottawa, Ont.

Wallingford Mica & Mining Co.,
Perkins, Que.

MINERAL WATER

Abenakis Mineral Spring Co., Limited,
W. E. Watt, Manager, Abenakis Springs, Que.

T. A. Fluet,
65, des Prairies St., Quebec City.

Radnor Water Co.,
503, McGill Building, Montreal, Que.

Cyprien Roy,
St. Germain, Kamouraska Co., Que.

St. Leon Mineral Water Co.,
R. W. Nebb, Manager, Toronto St., Toronto, Ont.

Veillet & Frere,
Ste. Geneviève, Batiscan Co., Que.

MOLYBDENITE

Aldfield Mineral Syndicate,
667 Echo Drive, Ottawa, Ont.

L. N. Benjamin,
55 St. Frs. Xavier St., Montreal.

Daley Molybdenite Co.,
Superior City, Douglas Co., Wis., U.S.A.

Dominion Molybdenite Co., Limited,
Quyon, Que.

M. L. Foley,
12 Maynard Ave., Toronto.

The Height of Land Mining Co.,
S. P. Wilson, Mgr., 316 St. James St., Montreal.

The St. Maurice Mines Co., Limited,
c-o B. Nielly, Cobalt, Ont.

Wood Molybdenite Company,
14 Metcalfe St., Ottawa, Ont.

NATURAL GAS

The Canadian Natural Gas Co.,
P. O. Box 2072, Montreal.

The National Gas Co., of Canada,
c-o Mr. E. B. Devlin, Hull, Que.

OCHRE AND IRON OXIDE

Argall's Oxide Mines,
P. O. Box No. 5, Three Rivers, Que.

Canada Paint Co., Limited,
Jos. Bradley, Manager, Red Mill, Que.

Champlain Oxide Co.,
Lucien Carignan, Manager, Three Rivers, Que.

P. Jobidon,
12 rue Ste. Famille, Quebec City.

François Ouellet,
Ste-Gertrude, Nicolet Co., Que.

Paint Products Co. of Canada,
Transportation Bldg., Montreal.

PEAT

Les Tourbières des Laurentides, Ltd.,
Ste. Flore, Que.

PHOSPHATE

Blackburn Bros.,
H. L. Forbes, Manager, Union Bank Bldg., Ottawa.

J. G. Higginson,
Buckingham, Que.

O'Brien & Fowler,
Bush Winning, Manager, Beech and Preston Sts., Ottawa.

Wallingford Mica & Mining Co.,
Banque Nationale Bldg., Ot awa.

Edward Watts,
19 Chesnut Park, Toronto, Ont.

SILICA, ROCK AND SAND

J. Bonnell,
Buckingham, Que.

Canadian China Clay Co.,
43 Victoria St., Toronto, Ont.

Cascades Silica Products Company,
103 St. Frs. Xavier, Montreal.

J. B. Gorman,
Box 166, Buckingham, Que.

Jos. H. Mason Smelting Co.,
180 Richmond St., Toronto, Ont.

J. McClements,
Buckingham, Que.

Montreal Sand and Gravel Co., Limited,
270 Ottawa St., Montreal.
Buckingham, Que.

G. Pedenaud,
Buckingham, Que.

Riordon Pulp & Paper Co.,
Hawkesbury, Ont.

A. Sicard,
St. Canute, Que.

Silica Products, Registered,
45 St. Alexander St., Montreal.

SILVER

Eustis Mining Co., Limited,
F. M. Passow, Manager, Eustis, Que.

Weedon Mining Company,
L. D. Adams, President, Weedon, Que.

Zinc Company, Limited,
Room 605, Eastern Township Bldg., Montreal.

TALC

J. N. Martel,
Belmina, Wolfe Co., Que.

Geo. R. Pibus,
Knowlton, Que.

ZINC AND LEAD

Federal Zinc and Lead Co., Ltd.,
285 Beaver Hall Hill.

The Laurentide Mining Co.,
Notre Dame des Anges, Portneuf Co., Que.

The New Richmond Mining Co.,
New Richmond, Que.

North America Mining Co.,
New Carlisle, Que.

Pierre Tétreault,
Room 416, Power Bldg., Montreal.

Zinc Company, Limited,
Notre Dame des Anges, Portneuf Co., Que.

BRICK

The Ascot Tile & Brick Co., Limited,
Ascot Corner, Que.

N. L. Auger,
Ville de St. Tite, Champlain Co., Que.

The Citadel Brick & Paving Block Co., Limited,
P. Galarneau, Manager, 320 St. Paul St., Quebec City.

La Compagnie de Briques de Deschaillons,
Deschaillons, Que.

La Compagnie de Briques de l'Islet, Ltée,
L'Islet Station, Que.

La Compagnie de Briques de Matane,
St. Jérôme de Matane, Que.

Jos. Desrochers,
Warwick, Que.

Rev. J. A. Genier,
Mount Laurier, Que.

David F. Hodgins,
Box 87, Shawville, Que

Emile Longpré,
St. Félix de Valois, Que.

National Brick Co. of Laprairie, Limited,
511, St. Catherine West, Montreal.

Ulderic Paris,
Village Deschaillons, Que.

Proulx Brothers,
Richmond, Que.

The St. Lawrence Brick Co., Limited,
71 St. James Street, Montreal, Que.

CEMENT

Canada Cement Co., Limited,
F. P. Jones, Manager, Herald Building, Montreal.

GRANITE

James Brodie & Son,
Graniteville, Que.

Brodie's, Limited,
128 Bleury Street, 'Montreal.

Joseph Brunet,
663 Côte des Neiges Road, Montreal.

A. L. Bussières,
St. Henri Village, Levis, Que.

Augustin Delisle,
Rivière à Pierre, Que.

Dumas & Frère,
Rivière à Pierre, Que.

William Duncan,
Graniteville, Que.

Filton & Parmenter,
North Derby, Que.

J. P. Gadbois,
326 Ave. Laval, Montreal.

Lacasse & Duncan,
Graniteville, Que.

J. C. Lacasse,
Beebe, Que.

The Megantic-Stanstead Quarry Co., Ltd.,
5, Bleury St., Montreal.

Pierre Moreau,
Roberval, Que.

Mme Jos. N. Perron,
Rivière à Pierre, Que.

R. A. Rideker,
Graniteville, Que.

Stanstead Granite Quarries Co., Limited,
Beebe Jct., Stanstead Co., Que.

LIME

Arnaud & Beaudry,
Joliette, Que.

Adolphe Barron,
La Carrière, Que.

Delphis Beauregard,
Stukely, Que.

Arthur Boivin,
Pont Rouge, Portneuf Co., Que.

R. B. Carswell,
Bryson, Que.

Achille Desilets,
St. Louis de Champlain, Que.

Dominion Lime Co.,
Sherbrooke, Que.

Lucien Doucet,
St. Louis de Champlain, Que.

Emery Héon,
St. Louis de Champlain, Que.

Octave Héon,
St. Louis de Champlain, Que.

Laurentian Stone Co., Limited,
Hull, Que.

Johnny Lefebvre,
St. Louis de Champlain,

Z. O. Limoges,
40, Poupart, Montreal.

Missisquoi Marbles Limited,
Philipsburg, Missisquoi Co., Que.

Thos. McCambly,
Kazubazua, Que.

Montreal Lime Co.,
31 Prenoveau St., Montreal.

Thos. Sharpe,
Coldwell, Que.

Sovereign Lime Company Limited,
Delorimier Ave. and C. P. R. Tracks, Montreal.

Standard Lime Co., Limited,
St. Paul, Joliette Co., Que.

St. Maurice Lime,
P. O. Box 479, Trois Rivières, Que.

LIMESTONE

Jos. P. Beaudry,
Joliette, Que.

Louis Bertrand,
Shawinigan Falls, Que.

Canada Carbide Company, Limited,
Power Building, Montreal.

Carrière de Québec, Lmitée,
15, rue St. Jacques, Quebec City.

La Cie des Carrières,
St. Marc des Carrières, Que.

La Cité de St-Hyacinthe,
St. Hyacinthe, Que.

La Cité de Hull,
Hull, Que.

Alderic Cousineau,
2455, St. Urbain Street, Montreal.

The L. Deguire Quarry Co.,
St. Laurent, near Montreal, Que.

The DeLorimier Quarry Co.,
1952 Iberville St., Montreal.

Frank Deraiche,
Chandler, Gaspé.

Deschambault Quarry Corporation,
52 St. Paul St., Quebec City.

The Deschambault Stone Co., Limited,
St. Marc des Carrières, Que.

Edgard Desormeaux,
Cap St. Martin, Laval, P. Q.

Pite Desrosches,
Joliette, Que.

R. C. Dickson,
601 Monsabré St., Montreal.

Cyrille Durocher.
5379 Notre Dame St., Montreal, Que.

The Federal Stone & Supply Co., Limited,
213 Sussex St., Ottawa.

Martin Gagnon & Fréres,
3363 Lajeunesse St., Montreal.

E. L. Gravel,
Château Richer, Que.

Francis Gravel,
Château Richer, Que.

Grondines Quarry Co., Ltd.,
704 Power Bldg., Montreal.

Institution des Sourds-Muets,
1941 St. Dominique St., Montreal.

Kennedy Construction Co., Limited,
310 Shaughnessy Bldg., Montreal.

The Félix Labelle Quarry Co., Limited,
St. François de Sales.

Georges Labelle,
St. François de Sales, Que.

Joseph Lapointe,
Cartierville, Que.

Laurentian Stone Co., Limited,
53 rue Albert, Hull.

Victor Lecrenier,
Cap St. Martin, Cte. Laval.

Narcisse Lord,
St. Jean, Que.

Maisonneuve Quarry Co., Limited,
2855 Boulevard Rosemont, Montreal.

O. Martineau & Fils, Limited,
371 Marie Anne Ave., Montreal.

R. H. Miner & Co., Ltd.,
Guarantee Bldg., Montreal.

Montreal Crushed Stone,
5 Beaver Hall Hill, Montreal.

Montreal Quarry Reg'd.,
800 Bellechasse St., Montreal

Jos. D. Naud
St. Marc des Carrières, Que.

Jos. Poulin,
Château Richer, Que.

Richelieu Quarry Co., Ltd.,
St. John, Que.

Thomas Rogers,
1701 Iberville Street, Montreal.

A. Simard,
Chambly, Que.

The St. Laurent Quarry, Limited,
Cap St. Martin, Laval Co., Que.

Standard Lime Co., Limited,
Joliette, Que.

Napoléon Tremblay,
Chenes Avenue, Hull, Que.

Villeray Quarry Co., Limited,
848 Du Rosaire Street, Montreal.

MARBLE

The Pontiac Marble & Lime Co., Limited,
193 Sparks St., Ottawa.

Wallace Sandstone Quarries Ltd.,
Philipsburg, Que.

POTTERY

W. D. Bell
1286 St. Valier St., Quebec City.

Canadian Trenton Potteries Co., Limited,
St. Jonh's, Que.

Citadel Brick & Paving Blocks Co., Ltd.,
Quebec.

Dominion Sanitary Pottery Co.,
189 St. James St., Montreal.

E. L. Farrar,
Iberville, Que.

David T. Hodgins,
Shawville, Que.

Montreal Fire-Brick Works, Limited,
399 St. Ambroise St., Montreal.

Montreal Terra-Cotta Lumber Co.,
23 Board of Trade Bldg., Montreal.

Standard Clay Products Limited,
St. Johns' Que.

SAND

Atlas Sand Company, Limited,
77 Common St., Montreal.

Jean Aybram,
St. Emelie Junction.

Robert Boa,
Hillhead, Que.

The Bonner Sand & Ballast Co.,
204 St. Nicholas Bldg., Montreal.

Keystone Wall Plaster Co.,
Ste. Thérèse, Que.

Laurentide Co., Ltd.,
Grand'Mère, Que.

Laurentide Sand & Gravel Co.,
2855 Boulevard Rosemont, Montreal.

Melançon Frère,
Grand'Mère, Que.

Montreal Sand & Gravel Co.,
270 Ottawa Street, Montreal.

Royal Moulding Sand & Gravel Co.,
St. Félix de Valois, Que.

St. Félix Sand & Gravel Co.,
Joliette.

Napoléon St. Louis,
Fontarabie, Maskinongé Co., Qué.

SANDSTONE

Cascades Silica Products Co.,
103 St. François Xavier St., Montreal.

Montreal Sand & Gravel Co., Limited,
270 Ottawa St., Montreal.

H. F. Routhly.
Haileybury, Ont.

The Sydney Kirby Co., Ltd.,
213 Sussex St., Ottawa.

SLATE

The New Rockland Slate Co.,
Room 408, Merchants Bank Bldg.,
205 St. James St., Montreal.

STATISTICS OF ACCIDENTS

REPORTED FROM THE MINES AND QUARRIES DURING THE YEAR 1919 *

A. O. Dufresne

The object in view in publishing and explaining the statistics of the accidents occurring in the Province is to call the attention of the workmen, the mine managers, and other persons interested, to the nature of the accidents, their number and causes. Two lists will be found in the appendix: one of the fatal accidents and the other of those that did not cause loss of life, but were of such a character that the workman was unable to work for ten days or more. This is the series of accidents which the Bureau of Mines classifies as serious. These lists are the vouchers for the tables preceding them. They are likewise published for the purpose of enabling any interested person to draw up himself supplementary tables needed for a special study.

These lists are made out by compiling the reports furnished by the operators in accordance with article 2213*a* of the Mining Law, enacted by the 23 George V (1911) section 8, which reads as follows: — If while a mine or a quarry is being worked, an accident takes place resulting in loss of life or serious injury, the person working the same or his representative at such mine or quarry, shall forthwith send a written notice to the Minister, specifying the nature of the accident, the number of persons killed or injured and their names if they are known. Every person not complying with the requirements of this article, shall be liable to the penalties provided in article 2207."

Statistics of accidents are compiled to aid those whose duty it is to secure the safety of workmen while at work. The tables facilitate this by showing the number and percentage of accidents under a classification carefully studied with a full knowledge of the premises and the mining methods. Each table is accompanied by a brief but complete analysis of the causes, and by suggestions regarding the safety of the workmen while at work.

* Translated from the French.

The mine managers while drawing up the safety rules for the management of their mining operations, can obtain ample information from these notes and also from those that have appeared in the annual Reports of previous years on the mining operations of the Province.

The present report on accidents is accompanied by eight tables: the first shows the relative importance of the various substances by indicating the number of workmen employed. The second deals chiefly with mines properly so called. It gives the number and total wages of the men working in producing and non-producing mines. The six others relate especially to accidents and give the proportions on the basis of 1,000 men working 300 days during a year.

Tables V and VI contain detailed analyses of the causes of the accidents. Table VII gives the age of the victims and the accidents are grouped by months in Table VIII.

Increased production in the mining industry has also increased the number of workmen who earn their living by it. From 7,791 in 1918, the number of those who worked in mines and quarries rose to 8,930 this year. All of these men did not work a full year. The deductions to be drawn from comparison between two years would be valueless if we did not bring the duration of these men's work down to a uniform basis. For instance a mine has been worked every day of the year except Sundays and holidays. A neighbouring one, has had its machinery working for 200 days only, owing to the market conditions or to many other reasons. Work in quarries is not usually carried on in winter time. Thus, in order to compare the statistics of one year with those of another, a common basis must be established.

In previous years the number of workmen employed for variable periods in the course of the year was reduced to the same denominator, namely: 300 working days. The operation is very simple: one has but to multiply the number of working men by that of the working days and then divide by 300. We then have the 300-day workman or the man-year. In some mines where work is continuous from one year to another owing to the methods followed, we have more than 300 days work, and in this case, in the

tables, it will be found that the number of men-years is greater than the number of workmen employed. There are certain disadvantages in connection with such reducing to a basis of 300 days, for it is then necessary that the number of working hours per day be the same for the various mines, etc. This is not the case. Thus, in most open cast pits and in quarries, the men work ten hours a day, while in some underground mines the day is eight hours, including half an hour in the middle of the day for lunch. To get accurate figures, it would thus be necessary that the basis be in hours and not in days. Unfortunately the data supplied by the operators do not allow of accuracy being pushed so far.

TABLE I

Persons employed in the Mines, Quarries and Annexed Mills in the Province of Quebec, during 1919.

Mines, Quarries and Mills	Number of men employed	Number of men calculated on 300 days	
	1919	1919	1918
Asbestos (quarries and mills)	4,031	3,806	2,984
Copper and Pyrite, Silver, Gold (mines and mills)	282	164	432
Chrome (mines and Mills)	183	138	319
Feldspar, Kaolin (pits and mills)	39	33	35
Graphite, Mica, Phosphate (pits and mills)	276	141	125
Iron Ore, Titaniferous Ore, zinc and lead	170	161	234
Magnesite	181	141	304
Mineral Water (springs and works)	18	8	3
Molybdenite (mines and mills)	83	69	196
Ochre	14	5	73
Peat	.....	....	....
Quartz and Silica (pits and mills)	91	27	32
Brick, Pottery (clay pits and mills)	915	639	344
Cement (quarries and mills)	526	640	472
Granite	229	177	170
Lime (quarries and kilns)	223	196	145
Limestone (quarries and dressing works)	1,127	556	428
Marble, Slate and Sandstone	158	136	13
Sand (pits and tivers	189	62	41
	8,930	7,161	6,350

Table No. I shows, in columns, grouped by the substances produced, the number of workmen employed during the year 1919 and, opposite this, the number of men on a basis of 300 days compared with that of the previous year. It will be observed that the total of 8,930 workmen who worked in mines, quarries, in separation or concentration mills, repair shops and power plants represents the working of 7,161 men during 300 days, compared with 6,350 for 1918, an increase of 12.7%. By examining these figures in details it will be seen that asbestos and mica were the only mineral substances giving employment to more men this year. On the other hand, building materials show a substantial increase for each item; and we find that the workmen employed in the latter category rose from 1,613 to 2,406, being an increase of 50% over the year 1918. This coincides with the production of building materials which has considerably increased this year. Taking the figures in the table of mineral production (page 00) this increase is calculated to be 51%. This revival of activity in the quarries is due to the resumption of building operations. *The Labour Gazette*, published by the Labour Department at Ottawa, states, in its number for March, 1920, that the sum total of the valuation of the new residential, commercial manufacturing and engineering buildings in the Province of Quebec, which was $23,631,700 in 1918, had risen to $55,266,800 in 1919.

TABLE II

	Number of workmen	Wages	Number of days' work	Number of men on 300 days basis
Producing Mines.....	5,444	$4,902,645	1,408,505	4,697
Non-producing mines	129	50,173	17,137	58
Total.....	5,573	$4,952,818	1,425,642	4,755

TABLE III

Workmen in	Number of men on 300 days basis	Accidents		Total	per 1,000 employed
		Fatal	Non-fatal		
Mines.....	4,755	9	315	324	68.4
Quarries.....	2,406	3	19	22	9.2
Totals.....	7,161	12	334	346	48.3

Table II relates exclusively to ore mines. In it will be found, summed up, the figures given in the foregiong table, after substracting the data regarding quarries. By non-producing mines are meant those in which work has been carried on during the year, but without shipping the ore that has been mined.

Nevertheless, no account is taken in this item of the assessment work required by the Mining Law for the retention of rights in mining claims. The table shows that a greater number of men worked in the mines this year: say 5,563 against 5,344 last year, being an increase of 4%. Reduced to a basis of 300 working days, the number of men-years is but a little more than for 1918. It will be found that they amount to 4,755 and 4,737 respectively. The aggregate wages of these workmen represent an increase of seven per cent over that of last year. The amount of the wages paid in ore mines is $4,952,818, while last year it was only $4,640,-671. The workmen in quarries received $2,385,551.

In the table of mineral production, (page 10), it will be observed that, for the year 1919, the total wages paid to workmen employed in exploiting the mineral resources of the Province amounted to $7,338,369; while, in the previous year, the same workmen received only $6,149,448, being an increase of 19%. The total of the wages represents an average of $1,025.00 and $968 per 300-day man, for the years 1919 and 1918 respectively. It will be interesting to recall the fact that in 1915 the average

wages of the workmen was only $593. For some years past a great deal of the work in asbestos mines is done by contract. Thus the loading of the cable-derrick-boxes at the bottom of the open pits is paid at the rate of so much per box. Under this system, labor is paid in proportion to the amount of work done and good results are obtained as regards both yield and cost price.

By non-fatal accident, the Bureau of Mines means any accident that prevents a workman from performing his usual work for a period of ten days or more, but does not cause loss of life. It is easy to verify whether the Minister receives notices of all fatal accidents, but it is otherwise in the case of non-fatal ones. Well organized companies have the necessary staff and generally send reports of these accidents. On the other hand, the small companies and individual operators, either through negligence or ignorance of the law, do not always send reports. The Bureau of Mines strives to educate the operators in this connection and also as to what concerns the dangers to be guarded against in mines and quarries. This twofold campaign has good results. It will be readily seen how important, in connection with this work of "safety first", is a complete knowledge of all serious accidents. This should prompt every operator to send in periodically a list of those accidents which have occurred at his mine or quarry. Blank forms are supplied by the Bureau of Mines for this purpose.

Statistics show that the number of fatal accidents per 1,000 men is smaller than that of the same accidents in the other provinces. Then, from year to year, the reports of non-fatal accidents are becoming more numerous. The companies, which formerly neglected to report, now send the required notice immediately after the accident has happened.

Table III shows the number of fatal and non-fatal accidents in mines and quarries and also the number of accidents per 1,000 men employed for each group. If there are more accidents in mines than in quarries it is due to the fact that working in mines is more dangerous, that extraction methods are different and that the managers of mining companies are more prompt in sending reports.

TABLE IV

Accidents in Mines, Quarries and annexed plants of the Province of Quebec for 1919.

	Fatal		Non-fatal		Totals	
	No.	%	No.	%	No.	%
MINES:						
Underground.....	4	1.1	27	7.8	31	8.9
Open pits.....	3	0.9	182	52.6	185	53.5
Surface.....	....	....	41	11.9	41	11.9
7	7	2.0	250	72.3	257	74.3%
QUARRIES:						
In pits.....	2	0.6	8	2.3	10	2.9
Surface.....	1	0.3	5	1.4	6	1.7
	3	0.9	13	3.7	16	4.6
ANNEXED PLANTS:						
Concentrators....	2	0.6	54	15.6	56	16.2
Shops.....	....	....	15	4.3	15	4.3
Power Plants.....	....	....	2	0.6	2	0.6
Totals.....	12	3.5	334	96.5	346	100.0%

During the year 1919 there were 346 accidents: 324 in mines and 22 in quarries. Nine of the fatal accidents occurred in the former and three in the latter: being 12 fatal accidents in all among 7,161 men employed throughout the year. The proportion per 1,000 men is thus 1.67; for the two previous years the average of fatal accidents was 2.7 per 1,000 men working 300 days. The number of fatal accidents in the year 1918 was abnormal, namely: 4.5 per 1,000 workmen. It was very different from the previous year when the proportion of fatal accidents was only 0.6 per thousand. The figures for mines and quarries are 1.68 and 1.66 per 1,000 men-years respectively.

A summary of the accidents would not be complete without a table classifying these accidents according to the two natural divisions of the mining industries namely: mines and quarries. The working of a mine or quarry nearly always requires mills for separating the mineral substances from the gangue, power plants, blacksmiths, and carpenters' shops and also machine shops for repairing tools and machinery.

Accidents occur from time to time in these various places. As machinery and the kind of work done in these plants for mines and quarries differ but little it has been deemed preferable to group all the annexed plants under the same classification which forms the third division of the tables. Thus table IV gives the fatal and non-fatal accidents in the three groups according which group they belong: mines, quarries and annexed plants.

The mines are subdivided according to the place where the accident occurred, namely: (*a*) in underground mines; (*b*) at the bottom of open pits and (*c*) at the surface of these same mines. As in Quebec there are no underground quarries, the accidents in quarries are subdivided according as they occurred either at the bottom or at the surface. As regards subsequent works, the accidents in the annexed plants for treating the ore in conformity with market requirements, they have been subdivided according to the place where they occurred: (*a*) in separation or concentration mills; (*b*) in repair shops; (*c*) in power plants.

It must be borne in mind that these statistics do not include accidents that have happened in brick or lime kilns and in cement mills after crushing. Such are accidents in connection with manufacturing and not with the working of quarries.

Tables Nos. V and VI are an analysis of the accidents. By studying them, one sees to what points the mine superintendent's attention should chiefly be called in order to seek means for eliminating whatever may cause temporary or permanent incapacity to work and sometimes even loss of life among workmen. It will be seen that rock-falls and slides are responsible for most of the accidents, say 43% in the case of fatal accidents and 37% in that of non-fatal accidents.

TABLE V

Analysis of fatal accidents in mines, quarries and annexed plants of the Province of Quebec for 1919.

	Underground	Open Pits	Surface	Total	
				No.	%
MINES:					
Rock falls and slides	3	....	....	3	43
Explosives	1	....	....	1	14
Cable Derricks	....	3	....	3	43
	4	3	....	7	100%
QUARRIES:					
Rock falls	....	2	....	2	66.6
Railroads	....	....	1	1	33.3
	....	2	1	3	100%
ANNEXED PLANTS:	Concentrators				
Shafting	1	....	....	1	50
Elevator	1	....	....	1	50
	2	....	....	2	100%
				12	

TABLE VI

Analysis of non-fatal accidents in Mines, Quarries and annexed Plants of the Province of Quebec for 1919.

	Underground	Open Pits	Surface	Total	
				No.	%
MINES:					
Rock falls and slides	12	80	2	94	37.6
Cable-derricks	....	58	1	59	23.6
Railroads	11	7	21	39	15.6
Falls	3	12	3	18	7.2
Miscellaneous	....	2	9	11	4.4
Hammering rock or steel	....	5	1	6	2.4
Steam shovels	....	6	....	6	2.4
Drilling	....	5	....	5	2.0
Explosives	1	3	1	5	2.0
Falls of object	....	3	2	5	2.0
Steam	....	1	....	1	0.4
Belts, Pulleys & Gears	....	....	1	1	0.4
	27	182	41	250	100%
QUARRIES:					
Railroads	....	1	3	4	30.7
Derricks	....	3	....	3	23.1
Rock falls	....	2	....	2	15.4
Hammering stone	....	1	....	1	7.7
Drilling	....	1	....	1	7.7
Fall	....	....	1	1	7.7
Fall of object	....	....	1	1	7.7
	....	8	5	13	100%
ANNEXED PLANTS:	Concentrators	Repair Shops	Power Plants	No.	%
Belts, Pulleys & Gears	15	2	....	17	24.0
Machinery	1	2	....	13	18.3
Falls	9	1	....	10	14.1
Falls of object	6	4	....	10	14.1
Miscellaneous	6	2	....	8	11.3
Rock falls	4	....	....	4	5.6
Hammering steel	1	1	....	2	2.8
Tools	....	2	....	2	2.8
Railroads	1	....	..	1	1.4
Explosives	1	....	....	1	1.4
Steam	....	....	1	1	1.4
Burns	....	....	1	1	1.4
Circular Saw	....	1	....	1	1.4
	54	15	2	71	100%

In underground mines the accidents caused by rock-falls are attributable to negligence in the care to be taken in scaling the roofs of drifts and of stopes. The rule is that, after every blast and when work is resumed at the beginning of each shift, the roof must be sounded and all pieces that do not ring clear must be removed with picks and crow bars. It is very important that this work be carefully done. In many mines the roof in the stopes is always completely scaled after every blast, Also, in the haulageways a special gang, told off for the purpose, examines the roof periodically and does all the necessary work for the trammers' safety. This work of scaling the roofs and walls is dangerous; out of three fatal accidents due to rock-falls in underground mines, two were caused by pieces of rock falling down while the roof is being scaled. In open pits the work is sometimes carried on at a great depth—295 feet at the King's mine. The long slopes formed by the rock slides at the foot of which many men have to work, always offer a danger of slides occurring. It its therefore necessary to follow a methodical system in the working so as to have a safe grade for the slope. Loading with steam-shovels, when possible, offers advantages in connection with the workmen's safety because it greatly reduces the number of men exposed to the dangers of rock-slides. This methods is in general use at East Broughton, Robertson and Asbestos. When workmen are working at the bottom of large open pits the walls must be closely watched and cleared of all loose rocks. In asbestos mines, after each big blast has been fired, and during spring and autumn thaws, gangs of men are told off to scale the walls. They work in pairs: one man goes down the slope slung in a strong rope held by his comrade and clears every bench and cavity containing anything likely to fall to the bottom of the pit.

The next in the category of the primcipal causes of accidents, after rock-falls and slides, is the method of loading ore with cable derricks. Loading the boxes at the bottom of the excavation and unloading them at the surface cannot be done without a workman, some time or another, getting a finger or a foot crushed. Then there is the hoisting of heavy stones with chains. The latter are frequently worn down and break. Foremen should take particular care with regard to the chains used in the works and recommend only those made of first class material, as low carbon open hearth

steel or the best quality of wrought iron. They must also see that they be used to lift only the safe loads allowed according to the diameter of the links. This is very important because overloading will strain them, thereby reducing the ductility of the metal which annealing cannot restore completely. The chains should be inspected once a week and be given a serial number to facilitate the recording of observations, wearing, deformations and flaws that have been noted. All chains with a defective link must be set aside because it must be borne in mind that the strength of a chain is that of its weakest link. There are many instances of stones falling while badly loaded of boxes were being hoisted. Cable-derricks, while conveying ore above the workings, are a continual source of danger. This could be eliminated if the workmen would keep far enough away while the boxes are being hoisted or lowered. In many mines the signals for the working of the cable-derricks are given by young boys from 14 to 16 years of age. The work is not fatiguing but requires much attention, and a moment's distraction, a wrong signal may cause loss of life.

The drilling of holes in mines by experienced workmen, especially drifts and also in breaking large blocks, is a source of danger. Nearly every year we have to record accidents caused by drilling in holes where there has been a misfire. It is therefore very important that the drill-runner should carefully examine the working face, before beginning to drill, in order to ascertain whether there are any misholes, as well as the depth and also the direction of the same. He must afterwards place his drill so that it will not work in such a direction that it may, at some moment, strike such a hole, and thereby cause an explosion. It is also strictly forbidden to use an old mine hole instead of drilling a new one to save time, for there is always a danger of some unexploded dynamite remaining at the bottom.

Several accidents are attributed to the breaking of stones with a hammer. In some asbestos mines and in quarries stone is broken with a sledge-hammer. Flying pieces of stone strike the workmen in the face and especially in the eyes, which means another one-eyed man through this process. This danger could easily be avoided by obliging the workmen to use goggles with thick glasses made expressly for the purpose. This precaution seems to be

completely neglected in the Province; it is taken elsewhere with good results.

Besides goggles, other protecting devices are on the market, of which the "chipping mask" is one. This is made of a screen of metallic wire, which is kept at a distance of a couple of inches from any part of the head by support which fits on like an ordinary head-gear. This chipping mask, made especially for protection from flying chips in the process of hammering rock, is called to render invaluable service in cobbing work.

The growing use of railways for conveying ore, both underground and on the surface, is accompanied by extra labour which increases with the extension of the tracks.

The loading and unloading of the cars and trucks, the coupling of the latter with the locomotives, the shunting on the side lines etc., require a numerous staff greatly exposed to accidents. The mine operators should redouble their vigilance and precautions for their workmen and also frequently renew instructions tending to reduce the danger of accidents of this kind.

In the annexed plants 24% of the accidents are caused by the belts, pulleys, gearing and shafts. All these should have good guards around them that no one come in contact with them unawares. These accidents generally occur while the belt is being put on or again while oiling the bearings. There should be a rule in every mill and shop that no oiling be done until the machines have stopped running. If some parts require to be oiled oftener, they should be provided with oil-cups reservoir lubricators of sufficient capacity to last throughout a five hour shift. Or again wire lattice screen should be put between the lubricator and the pully or gearing of sufficient size to prevent the workman from coming in contact with the belts or cogs. It must not be inferred from the foregoing nor believed that all the precautions above suggested are neglected in all the mills and other plants. In several of the large separating and concentration mills the owners have put guards around high velocity belts, covers over the geatinW have been put guards around high velocity belts, covers over the gearings, railings around the openings in the floor, sheet-iron

guards, wire lattice work, cages and netting around the moving parts of the machinery, etc. These apparatus render great services, but the mine operators must see that they are always in their place. Steps must also taken to keep the workmen ever alive to the necessity of being prudent and of always acting so as to eliminate all sources of danger.

TABLE VII

Aged of the Injured, for 1919

	15-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	Above 65	Unknown	Total
Non-Fatal....	47	57	63	49	31	20	21	11	10	4	2	19	334
Fatal.....	..	2	4	1	2	1	..	..	..	..	1	1	12
	47	59	67	50	33	21	21	11	10	4	3	20	346

TABLE VIII

ROCK FALLS AND SLIDES, BY MONTH, DURING 1919

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
NON-FATAL													
Underground	..	2	1	..	..	..	..	2	1	1	2	3	12
Open Pits	4	6	7	5	2	9	8	7	6	6	9	11	80
Quarries	..	..	..	..	..	..	..	..	1	..	..	1	2
FATAL													
Underground	..	..	..	1	..	..	..	1	..	1	..	..	3
Open Pits	..	..	..	..	..	.. ..	..	..	..	..	..	..	..
Quarries	..	..	1	..	..	..	..	1	..	..	..	..	2
	4	8	9	6	2	9	8	11	8	8	11	15	99

FATAL ACCIDENTS DURING THE YEAR 1919

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Injury and Cause of Accident
1	Mar. 4	Mr. A. Carrier's sand pit.....	Willie Lemay.....	28	Teamster.....	Instantly killed by a lump of overhanging gravel falling from a height of 7 or 8 feet.
2	Mar. 31	Jacob's Asbestos Mining Co., Ltd...	Jos. St. Pierre.....	40	Driller.....	Injured was operating a one man blockholing machine in open cast pit under cable-derrick, when he was hit by a descending empty box, which when stopped close to the ground swung back towards him and jammed him against his drill injuring him very seriously internally.
3	Apr. 11	Jacob's Asbestos Mining Co., Ltd...	Mat Czek.....	37	Miner.....	Deceased and his partner as co-contractors were putting through a raise from the first-level. They were working at a height of 100 feet from level barring down the loose preparatory to drilling and were standing on a platform they had erected for the purpose. The partner advised the victim not to stand on planks but on sprag. He refused to hear the advise, and on prying off a piece of rock it fell on the plank, breaking it. The victim was found dead at the bottom of the raise.
4	Apr. 25	Black Lake Asbestos and Chrome Co., Ltd.	Ivan Katarinuk.....	30	Labourer.....	The man was working in open cast pit on track between two cars. A large stone was being hoisted a short distance away; as the stone left the ground it swung forward striking one of the cars and upsetting it. The man had skull crushed between the two cars.
5	May 14	Weedon Mining Co., Ltd.....	Napoléon Scott.....	25	Driller.....	Victim was drilling in cross-cut into the foot wall from No. 2 stope, level 9. He drilled into a missed lifter which exploded causing his death and injuring slightly two other men.
6	May 15	Jacob's Asbestos Mining Co., Ltd...	Alfred Bisson.....	27	Crusher man.....	No one saw the accident. Deceased asked for and received some belt dressing to apply to the head drum of rock conveyor to mill and he was later found dead at the point jammed between the aforesaid drum and the boxed-in gears driving it.

7	June	30	Black Lake Asbestos and Chrome Co., Ltd.	John Zekirouk	—	Mill hand	He was operating an elevator used for transferring bags from mill to store shed. He was going up with truck load of bags, when within three feet of upper floor, the elevator stopped due to drum slipping on shaft. The elevator slowly backed down, man became alarmed and caught edge of floor and as top of elevator came by he was caught and had both hip bones fractured.
8	Aug.	12	O. Martineau & Fils, Ltée	Auguste Bélair	67	Quarryman	Had two legs fractured and stomach crushed in by slide of rock falling from face of quarry while working in bottom.
9	Aug.	27	Bell Asbestos Mines	Alphonse Leclerc	29	Miner	Injured was barring down loose rock at face of tunnel when a big lump of clay and stones fell from near roof; fracturing spine.
10	Oct.	9	Canadian China Clay Co., Ltd	Georges Grenier	32	Miner	Was working in a tunnel near shaft struck by lump of clay that dropped from roof. He fell backwards striking head on edge of bucket, causing contusion of brain.
11	Nov.	18	Pennington Asbestos Co.,	Basil Keavecomolvice	45	Labourer	Victim working at bottom of open cast pit when piece of rock fell from travelling cable-derrick box, fracturing skull.
12	Nov.	27	National Brick Co., of Laprairie Ltd, Laprairie Plant.	Joseph Valin	25	Brakesman	Fell from clay cars which passed over him. Killed instantly.

5th March.—At St. Barnabé, county of St. Maurice, Willie Lemay, 28 years old, carter for Mr. A. Carrier, contractor, was killed by a gravel slide.

He was working with a companion in a sand-pit when a rather large block of gravel became detached from a height of seven or eight feet and fell on Lemay's head.

31st March.—At the Jacob's mine in Thetford, Joseph St-Pierre, 40 years old, a drill-runner, was seriously injured by a cable-derrick box. He died, on the 16th April in the Sherbrooke hospital through a fracture of the spinal column. According to the evidence given at the coroner's inquest, he was drilling some blocks of rock on a bench some 15 feet from the bottom of the open cast pit, underneath cable-derrick No. 7. When the accident happened he was working alone in that section; the workmen who loaded the boxes on a contract basis were resting and warming themselves in the pump building. The derrick had been working during the morning but had stopped over an hour before the accident. The hoist-man let the carriage run along the cable. The signaller, a boy 14 years old, seeing that it had passed the usual stopping point, gave the signal to stop, but without result. The carriage went beyond the stopping point and the hoist-man let the box run down rather swiftly but slowing it gradually as it descended. The signaller, seeing the box swinging as it came down over the place where a workman was drilling block holes, gave the signal to stop several times, but it seems that it was not heard by the hoist-man. The box struck St. Pierre who, being occupied with his work, did not see it coming down while the noise made by his drill prevented him from hearing the shouts of his companions who were farther away.

It appears from the evidence that this was not the first time this signal-bell had not worked properly and that it had been repaired several times by the company's electrician.

The jury's verdict at the inquest held on the 13th May, implicates the company with neglect in the maintenance of its signal apparatus.

11th April.—Mat Czek, 37 years old, an Austrian miner in

the employ of the Jacob's Asbestos Mining Co. of Thetford, Ltd. was killed by a rock-slide while scaling the upper part of a raise from the first level in the mine.

Work had been carried on for some time in connection with driving a "Glory Hole" raise from the first level to the surface. The latter was a little over a hundred feet high when the accident happened. Some blasts had been fired in the upper part and it was necessary to scale the roof and assure the safety of the drill-runners when drilling could be resumed. Czek and a companion were told off to do the work, and, to facilitate it, two stulls of nine inch timber were put on each side against the walls at the place where the work was to be done. Two three-inch deals were put on these timber pieces.

During the afternoon the workmen were at work. Czek's companion thought that a loose piece of rock in the roof, quite near the wall, might in falling break the boards forming platform and put the two men in a very dangerous position. He warned Czek accordingly.

The latter did not deem it advisable to heed the warning and continued to loosen the stone. After he had worked a little while, it fell on the deal, broke it carrying Czek down with it as it fell. He was picked up with a bad fracture at the base of the cranium, the upper left side of the thorax crushed in and several lacerations. His companion, who was standing on the heavy timber, escaped without scratches.

Verdict: accidental death.

27th April.—At the asbestos mine of the Black Lake Asbestos and Chrome Co. Ltd., Ivan Katarinof, 30 years of age, a miner, was killed instantly.

The victim was working in the company's large open-cast pit; he had charge of the unloading the cable-derrick boxes into the cars at the bottom of the pit. In the latter the cable-derricks are run erected transversally to its length and two parallel railway tracks run along the west wall in the direction of the length.

There were cars on the two tracks when the accident happened. While he was pushing a car with a crow-bar in order to get it exactly under cable-derrick No. 2, some workmen, on the face of the same working, were hoisting with chains two rocks weighing about 1,200 pounds, to transport them farther on and have them drilled. As the cable-derrick is at a height of at least 100 feet above the bottom of the open pit and the face of the working is barely more than 25 feet from the first railway track and as the rocks in question were outside the axis of the cable-derrick, the rocks when lifted, described a wide arc. The rocks were lifted only a few feet above the ground. The hoist-man did not obey the signal to lower as soon as it was given him by the signaller, a boy 14 years old, and the load struck and upset the car in the first track just as the victim, who was proceeding towards cable-derrick No. 1, passed between the two tracks. The head of the unfortunate man was wedged between the two cars. His death was instantaneous, the skull being fractured in the region of the left temple.

Verdict: accidental death.

14th May.—Napoléon Scott, 25 years of age, drill runner in the employ of the Weedon Mining Company, was killed by the explosion of a mishole.

Scott, a drill-runner's assistant and a shoveller were working in a cross-cut in level No. 9 on the north side of shaft No. 3. Some blasts had been fired the previous evening in the face of that cross-cut. According to the evidence at the inquest and an examination of the spot, it appears that the lower holes had misfired. A stone bank, in the shape of a step about ten inches high, had remained at the bottom of the cross-cut. With the intention of removing that stone bank, Scott put up his drill to bore vertical holes. The miners had previously removed the broken ore covering the bottom of the cross-cut, but not enough to perceive the misfires of the previous blast-holes drilled in a horizontal direction. The foreman of the night work had ordered Scott to examine the condition of the place before beginning the drilling. This order does not seem to have been followed. The drill had been working for several minutes and had drilled a hole about eight inches deep, when an explosion happened. The drill-bit was being driven in the direction of a

hole in which a dynamite cartridge had remained. The explosion killed Scott, wounded his assistant and the shoveller who was about ten feet away.

External examination of the body revealed a complete destruction of the hemisphere of the brain caused by a pointed piece of stone driven bullet-like, completely though the skull; there were also several fractures and death was instantaneous. The assistant had a quantity of dust driven into his neck and right cheek, while the shoveller was blind of both eyes for some days through inflammation caused by the dust.

15th May.—Alfred Bisson, 27 years old, employed in the separating mill of the Jacobs' Asbestos Mining Co. of Thetford, Ltd., was found dead in the upper part of a conveyor belt.

Nobody had any knowledge of the accident as it happened in an isolated place.

From the base of the large jaw-crushers, at the foot of the head frame of the mine shaft, a belt 24 inches wide, inclined at an angle of 17°, carries the broken stone to the head of the mill at a distance of 115 feet. This belt travels at a speed of 250 feet a minute. Cobbing boys were working in the mill when they saw a bloodstained cap pass over a table. They gave the alarm at once and a search was made resulting in the discovery of Bisson's body between the drum and the cog-wheel of the upper part of the belt described above; the head and arms were hanging down towards the ore bin and the left leg was on the belt. The examination made by the physician showed that the right lung was crushed in and that several limbs were fractured. Dead was attributed to pulmonary compression.

The accident seems to have occurred while the victim was laying a coat of a resinous preparation on the drum to make the belt adhere better and work well. While he was pouring the solution on the drum, the *tin-can* utensil containing the preparation was probably carried in between the drum and the belt and, in trying to get it out, he was dragged in and crushed against the cog-wheel.

30th June.—At the asbestos mines of the Black Lake Asbestos

and Chrome Co. Ltd., John Zékirouk, employed in the separating mill, was killed while trying to get out of an elevator hoist in motion.

Zekirouk was conveying asbestos bags by means of the hoist communicating between the mill and the warehouse. He was going up from the first floor, when within a distance of three feet from the second floor, the hoist stopped and began to go down slowly. In a moment of excitement, Zekirouk wanted to get out of the hoist. He hung on to the floor and before he could right himself one of the frame-pieces of the hoist caught him crushed him against the joist. He was picked up with both hips fractured and died some minutes afterwards. The cause of the accident is attributed to the fall of the key holding the drum, on which the hoist cable winds, to the crank-shaft.

1st August.—Auguste Bélair, 67 years old, Zéphirin Lapierre and a third workman were working at the Rosemont quarry of O. Martineau & Fils, Montreal, loading stones in a box on a truck which was afterwards rolled under the arm of the crane hoisting the box and emptying its contents at the surface. The method followed in this quarry consists in drilling a series of holes 30 feet deep which are filled with dynamite. The rock comes down in large blocks weighing from 1,200 to 1,500 pounds, which are afterwards broken up with small charges of dynamite.

When the accident happened Auguste Bélair was removing the stones from the bottom of the quarry with an iron crow-bar; a piece of stone about three cubic feet in dimension rolled from a height of about 15 feet, hurled Bélair against the truck breaking both his legs and inflicting many contusions. He died some hours later, the death being due to compound fracture of the legs, contusions, hemorrage and shock.

27th August.—Alphonse Leclerc, 29 years of age, employed as a miner in the Bell Asbestos Mines, Thetford, was struck by a piece of rock detached from the face of the tunnel which he was scaling. He died four days after. The accident occurred in a tunnel which was then over 800 feet long, its section being 14 feet wide and 17 feet high.

At this point the tunnel runs through a bad piece of ground.

A portion of the rock has been decomposed by water filtering. through it from the surface and the stone is easily disintegrated To ensure the men's safety while working, good timbering has been put up whose lagging touch the front of the tunnel.

For greater safety, the mine manager had decided to drive a smaller preliminary tunnel until the bad spot was got over. To that end, some blasts had been fired about the lunch hour. On their return the miners had cleared the face of all stones that seemed dangerous.

This work was finished and Leclerc was going back to speak to the mine superintendent, when a stone weighing about 25 pounds fell down from the face just close to the roof and struck him in the back between the shoulders. The victim died four days afterwards of paralysis of the lower limbs, inflammation of the brain and spinal marrow caused by a probable fracture of the second upper dorsal vertebra.

9th October.—At the kaolin mine of The Canadian China Clay Co., Ltd., at St. Remi d'Amherst, George Grenier, a miner, 32 years of age, was killed by a lump of clay falling from the roof of an underground drift.

The victim with three companions was working at timbering this drift four feet from a large diameter block cribbed shaft. A lump of clay fell on his head and, in falling, struck his head on a bucket. He died half an hour later from contusion of the back of his head.

15th November.— At the Pennington mine, Thetford Mines, Basil Karambovitch, 43 years of age, was killed by a stone falling from the box of a cable-derrick.

At this mine, owing to the smallness of the open pit, there is room for only four cable-derricks. With a view to greater production, several gangs are lined up for and under the same cable-derrick, which serves each of these gangs in turn. Karambovitch belonged to the second gang working under cable-derrick No. 2. The latter was hoisting a box loaded by the furthest gang; while passing at a height of a hundred feet above the second gang, a stone

fell from the box and struck the workman at the bottom of the open pit. The physician who examined the body found a fracture an inch and a half in the upper part of the skull, exposing the brain. The victim died 24 hours after.

It happens rather often that stones fall from the boxes as the latter are being conveyed along the cables. It is, therefore, very important, from the standpoint of safety, that precautionary measures be taken for the protection of the men working at the bottom of a pit. Care should be taken to have no man working under a box in motion.

27th November.—At the Laprairie quarry of the National Brick Co. of Laprairie, Ltd., Joseph Valin, a brakesman, 25 years of age, was killed by a shale train.

The accident occurred on the company's narrow gauge railway. Valin had signalled the locomotive driver to start after switching the train on the right track and he fell between the cars while trying to get on the train. His head was broken by the frame work of the locomotive.

MINES, QUARRIES AND ANNEXED BUILDINGS IN THE PROVINCE OF QUEBEC

NON-FATAL ACCIDENTS DURING THE YEAR 1919

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
1	Jan. 3	Jacob's Asbestos Mining Co., Ltd..	A. Garneau.....	16	Bell boy.....	Three fingers cut off by the explosion of detonator with which he was playing.
2	Jan. 8	Asbestos Corporation of Canada Ltd Beaver Mine.	Art. Roy.....	32	Labourer.....	Left leg injured by fall in moving rope in pit.
3	Jan. 11	Asbestos Corporation of Canada Ltd. Beaver Mine.	A. Dutil.....	21	Labourer.....	Left leg struck by rolling rock.
4	Jan. 11	Canadian Johns, Manville Co., Ltd.	Od. Côté	18	Jackman.....	Hip squeezed between cars and steam shovel.
5	Jan. 11	Mutual Chemical Co., Ltd.....	Alphonse Doyon	35	Shoveler.....	Fracture of spine caused by slipping from landing while calling to men below, saved his life by catching hoisting rope.
6	Jan. 13	Black Lake Asbestos & Chrome Co. Ltd., Pit No. 9.	W. A. Sinclair.....	35	Labourer.....	Dislocation of hip caused by swinging empty cable derrick box.
7	Jan. 14	Jacob's Asbestos Mining Co., Ltd...	Louis Duchesne.....	46	Carpenter.....	Cut off left hand finger while sawing a piece of board for a pattern in shop.
8	Jan. 17	Federal Asbestos Company.....	Leo Beaudoin.....	50	Foreman.....	Skull fractured when struck by a post in unloading a car.
9	Jan. 17	Canadian Johns Manville Co., Ltd.	Ovila Langlois.....	17	Repairer.....	Lacerated wound to left eyebrow by flying hammer while at work in machine shop.
10	Jan. 18	Asbestos Corp. of Can. Ltd., B. C. mine.	E. Nolet.....	48	Labourer.....	Right foot caught by cable-derrick box, while it was being lowered.
11	Jan 18	Asbestos Corp. of Can. Ltd, King's mine.	L. Turcotte.....	31	Labourer.....	Struck on legs by rock rolling from jam.
12	Jan 20	Canadian Johns-Manville Co., Ltd..	Georges Boucher	26	Brakesman	Hand caught by slipping bar while prying up box of car.
13	Jan. 21	Bell Asbestos Mines.....	Honoré Dubois	31	Labourer.....	Right eye badly injured by flying piece of steel which broke off from steel bar while hammering it in barring loose rock.
14	Jan. 21	Asbestos Corp. of Can., Ltd., Fraser mine.	Ernest Poulin.....	48	Labourer.....	Legs hurt, was caught between jams and cable-derrick box.
15	Jan. 23	Bell Asbestos Mines.....	Jos. Côté	48	Labourer.....	Left foot bruised by rolling stone from jam.
16	Jan. 23	Bell Asbestos Mines.....	Charles Nadeau.....	36	Dumper.....	Contused left leg caused by swinging rope attached to hoist pulling cars.
17	Jan. 23	Jacob's Asbestos Mining Co., Ltd.	Frank Cryan.....	33	Trackman.....	While working on track underground he caught his right leg between car and electric locomotive.
18	Jan. 27	Mutual Chemical Co., Ltd.....	J. B. Roy.....	35	Miner.....	In helping a team hitched to the back of sleigh to pull it out of a hole. The pole swung and hit him on the knee.

NON-FATAL ACCIDENTS 1919.

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
19	Jan. 28	Bell Asbestos Mines	Henri Simard	39	Engineer	Injured left hand between gear and a pipe on steam-shovel.
20	Jan. 28	Jacob's Asbestos Mining Co., Ltd.	Ls. Seidsky	53	Contractor	Finger caught between rocks while loading cable-derrick box.
21	Jan. 29	Jacob's Asbestos Mining Co., Lts.	Omer Duguay	23	Foreman	Right hand badly crushed between two gears while putting ashes on a conveyor belt.
22	Jan. 29	Asbestos Corp. of Can. Ltd., King's	F. Faluc	50	Labourer	A rock fell from jam and struck him on right arm.
23	Jan. 30	Asbestos Corp. of Can. Ltd., Beaver mine.	J. A. Nadeau	40	Yardman	Broke left leg, while moving hoist.
24	 1	Asbestos Fibre Mining Co	Alph. Blanchette	28	Labourer	Stone rolled on leg while working on surface.
25	 1	Asbestos Corp. of Can. Ltd., Beaver mine.	Nap. Dostie	24	Labourer	While piling bags he had his breast sprained.
26	 1	Bell Asbestos Mines	Ovila Paquet	28	Labourer	As he was lifting a big stone it broke off to pieces and one fell on his right foot.
27	 3	Bell Asbestos Mines	Pierre Bergeron	58	Labourer	Inpicking up stone to load cable-derrick box another fell on his left hand.
28	 4	Asbestos Corp. of Can. Ltd., King's Mine.	Pierre Proulx	31	Labourer	Stone fell from side of pit and struck him on right shoulder.
29	 5	Asbestos Corp. of Can. Ltd., Beaver Mine.	Eus. Theberge	32	Labourer	Stone fell on his foot while at work in pit.
30	 6	Asbestos Corp. of Can. Ltd., Beaver Mine.	W. R. Maywood	34	Labourer	Two fingers cut off when caught between pipes and flange hammers.
31	 8	Asbestos Corp. of Can. Ltd., King's Mine.	A. Filteau	34	Labourer	Left eye injured by piece of steel which flew from hammer.
32	Feb. 10	Canadian Johns-Manville Co., Ltd.	Charles René	24	Brakesman	While dumping cars, and using a bar as pry,a signet ring on finger caught between pry and iron on car tearing ring off lacerating finger badly.
33	Feb. 12	Canadian Johns-Manville Co., Ltd.	Alfred Kendall	41	Foreman	Large rock rolled against left ankle causing a flattening of arch of foot.
34	Feb. 14	Johnson's Company, Thetford Mine.	Baptiste Beaulieu	60	Labourer	Breaking stone with sledge hammer a small piece of the stone struck him on left eye.
35	Feb. 14	Asbestos Corp. of Can. Ltd., Beaver Mine.	A. Prevost	25	Labourer	Was struck on right side by stone which fell from jam in pit.
36	Feb. 14	Zinc Company Ltd	F. Petit	35	Trammer	Prying rock in chute underground with bar, when rock falling, caused bar to fly out and hit man on ribs.
37	Feb. 18	Asbestos Corp. of Can. Ltd., King's Mine.	Aimé Bourret	44	Cobber	While cobbing crude asbestos, piece of rock struck him in the eye.
38	Feb. 18	Asbestos Corp. of Can. Ltd., King's Mine.	Joseph Huard	44	Labourer	Struck on shoulder by piece of frozen earth.

39	Feb.	19	Federal Asbestos Company	A. Grégoire	22	Carpenter	Cut right thumb on planer in straightening a piece of lumber.
40	Feb.	19	Federal Asbestos Co	J. O. Landry	43	Labourer	Bruised his finger in repairing dryer.
41	Feb.	20	Asbestos Corp. of Can. Ltd., King's Mine.	A. Vachon	23	Labourer	While loading a cable-derrick box a piece of rock fell of his left foot.
42	Feb.	22	Asbestos Corp. of Can. Ltd., King's Mine.	Edgar Poirier	25	Labourer	Sprained his back while lifting stone.
43	Feb.	24	Canadian Johns-Manville Co., Ltd.	Boromée Girouard	22	Driller	Hand caught under large rock he was turning over.
44	Feb.	26	Jacob's Asbestos Mining Co., Ltd.	Chs. Rodue	28	Miner	Left foot and knee injured by fall of rock from shaft pocket.
45	Feb.	27	Jacob's Asbestos Mining Co., Ltd.	Ph. Dussault	48	Shoveler	While shovelling dirt into Glory-hole, a piece of froz n dirt which he was standing on, broke away and he fell, spraining his left ankle.
46	Feb.	27	Federal Asbestos Co	Ivan Chaubakuck	45	Labourer	Leg broken, caught between a rock and cable-derrick box.
47	Mar.	1	Asbestos Fibre Mining Co	Donat Goyon	21	Labourer	Slid down rope and came down too fast spraining ankle an reaching ground.
48	Mar.	4	Bell Asbestos Mines	Emile Provencher	19	Labourer	While hoisting a cable-derrick box in pit it swung around and jammed his right foot against a big stone.
49	Mar.	4	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Peter Topping	62	Fireman	In opening a valve the steam scald his left hand.
50	Mar.	5	Asbestos Corp. of Can. Ltd., B. C. Mine.	Eug. Goulet	29	Labourer	Was hurt by stones when dynamite exploded when struck by his pick.
51	Mar.	7	Jacob's Asbestos Mining Co., Ltd.	M. Natzuk	29	Shoveler	While loading rocks into a cable derrick box, another rock which rolled from jam struck his right hand.
52	Mar.	7	Asbestos Corp. of Can Ltd., King's Mine.	A. Joly	24	Labourer	Piece of rock fell from jam and struck him on right hip and left leg.
53	Mar.	8	Dominion Lime Co	Joseph Veilleux	37	Labourer	Was putting block hole in boulder by hand drilling and was holding bar. Man striking drill missed the same hitting injured on right hand.
54	Mar.	8	Asbestos Corp. of Can. Ltd., Beaver Mine.	A. Dussault	23	Labourer	Cut at head, struck by stone.
55	Mar.	12	Jacob's Asbestos Mining Co., Ltd.	Howard Purdy	32	Shiftboss	While at work in a rock-chute, a stone fell from top striking him on chest and right shoulder.
56	Mar.	12	Asbestos Corp. of Can Ltd., Beaver Mine.	A. Daigle	33	Labourer	Fell in pit going down the ladder.
57	Mar.	15	Bennett-Martin Asb. & Ch. Mines Ltd., Thetford.	F. Maheu	30	Labourer	As this man was loading a cable-derrick box, a large stone fell from side of pit and crushed his left leg against the side of the box.
58	Mar.	20	Federal Asbestos Co	Treflé Lessard	39	Labourer	Cable-derrick box upset and fell over him, spine injured.
59	Mar.	20	Federal Asbestos Co	Pierre Bégin	33	Labourer	Was struck on hand by piece of stone.
60	Mar.	20	Zinc Company Ltd	D Lambert	25	Millman	Toe crushed by casting falling from Butchard table.
61	Mar.	21	Asbestos Corp. of Can Ltd, B.-C. Mine.	C. Guillemette	21	Labourer	While loading a cable-derrick box, a stone fell on his left foot.

NON-FATAL ACCIDENTS 1919.

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
62	Mar. 21	Jacob's Asbestos Mining Co., Ltd...	Emile Audette.....	24	Driller.....	Was setting up drill near side of pit when small rock fell from above and hit him on head.
63	Mar. 21	Jacob's Asbestos Mining Co., Ltd...	Fred. Fontaine.....	34	Pumpman.....	Climbing stairs from bottom of open cast pit a small rock fell on his head from side of pit.
64	Mar. 23	Zinc Company Ltd.....	V. Rivard.....	26	Trammer.....	Riding on side of car, when passing chute crushed between car and chute.
65	Mar. 24	Jacob's Asbestos Mining Co., Ltd...	R. Roberge.....	15	Machinist.....	While working on a lathe, got his left elbow injured by chuck while in motion.
66	Mar. 26	Johnson's Company, Thetford Mine.	Moïse Croteau.....	35	Labourer.....	Stone falling from side of pit struck right leg, bruising same.
67	Mar. 26	Asbestos Corp. of Can. Ltd., B.-C. Mine.	L. Montminy.....	41	Labourer.....	Struck by sheet of iron in pit.
68	Mar. 26	Asbestos Corp. of Can. Ltd., King's Mine.	Jean Aubé.....	18	Labourer.....	Stone fell on hand, bruising same.
69	Mar. 26	Canada Carbide Co., Ltd.....	Sostani Polici.....	31	Labourer.....	Was breaking stone with hammer when a fragment of stone, flew off to his right eye.
70	Mar. 28	Asbestos Corp. of Can. Ltd., King's Mine.	Alp. Trahan.....	21	Driller.....	A piece of rock fell from side of pit and struck him on head, causing a cut.
71	Mar. 29	Jacob's Asbestos Mining Co., Ltd...	Alex. Frederick.....	30	Dumper.....	Had his right foot sprained by a car which jumped the rails.
72	Mar. 31	Johnson's Company.....	A. Demers.....	20	Teamster.....	Leaving his work he went into mill and was trying to shift belt while mill was running, arm sleeve of coat caught between pulley and belt, with result that man had bone of right wrist broken.
73	Apr. 1	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Ant. Roulcau.....	18	Labourer.....	Fell and struck right knee on a bolt.
74	Apr. 3	Federal Asbestos. Co.....	Nap. Dulac.....	21	Labourer.....	Finger smashed, caught in a pulley.
75	Apr. 3	Johnson's Company.....	L. Hamelin.....	21	Labourer.....	Hand bruised, caught between rock and hoisting chain.
76	Apr. 3	New Rockland Slate Co. quarry...	Edward Williams.....	58	Quarryman.....	Leg broken below knee, when struck by stone which was being removed by derrick.
77	Apr. 3	Jacob's Asbestos Mining Co., Ltd...	Fred. Sylvain.....	34	Millwright.....	Injured finger of left hand, while repairing machinery in mill.
78	Apr. 5	Bennett-Martin Asb. & Chrome Mines Ltd., Thetford Mine.	Achilas Filteau.....	28	Labourer.....	Left leg caught between box of cable-derrick and a piece of rock.
79	Apr. 5	Asbestos Corp. of Can. Ltd., King's Mine.	Adélard Grégoire.....	19	Labourer.....	Cut to the right leg when struck by rock which fell from jam.
80	Apr. 7	Jacob's Asbestos Mining Co., Ltd...	J. B. Couture.....	71	Millman.....	While going to work in mill he slipped and fell injuring left knee.
81	Apr. 9	Asbestos Corp. of Can. Ltd., B.-C. Mine.	D. Gioconelli.....	42	Labourer.....	Right foot sprained caused by fall of rock.

82	Apr.	10	Asbestos Corp. of Can. Ltd., King's Mine.	Mathias Martel	48	Labourer	Sprained his back while lifting rocks.
83	Apr.	10	Asbestos Corp. of Can. Ltd., Beaver Mine.	Ernest Laliberté	36	Labourer	Shaft rolled on foot, bruising same.
84	Apr.	11	The Penpington Asbestos Co.	Philippe Hughes	32	Miner	Struck by a loose rock, loss little finger of left hand.
85	Apr.	11	Jacob's Asbestos Mining Co., Ltd.	E. Martineau	21	Millman	Left hand bruised between belt and plank near same, while feeding a conveyor in mill.
86	Apr	12	Canadian Johns-Manville Co., Ltd.	Antonio Beaudette	26	Jackman	Workman was striking a bar and a piece of steel flew off and struck him in the eye causing total blindness.
87	Apr	14	Jacob's Asbestos Mining Co, Ltd	Ovila Vaillancourt	22	Miner	Going down incline on a car to open switch, he was caught between car and a rock squeezing his chest.
88	Apr	14	Federal Asbestos Co.	Cyrille Paré	44	Labourer	Body strained in falling from step ladder in mill.
89	Apr.	14	Federal Asbestos Co	Amédée Shink	33	Labourer	Body strained when struck by rope.
90	Apr	16	Canadian Johns-Manville Co, Ltd.	Thos. Wolfe	21	Machinist	Straining of pectoral muscles when rail fell while he was holding one end of it on a saw table.
91	Apr.	18	Jacob's Asbestos Mining Co, Ltd	Ed Bertrand	18	Driller	In lifting a log it fell on foot bruising same.
92	Apr.	23	Jacob's Asbestos Mining Co., Ltd.	Louis Nadeau	21	Shoveller	While placing a cable-derrick box for loading purposes it struck him on left shoulder bruising same.
93	Apr	23	Asbestos Corp. of Can. Ltd., King' Mine.	Arthur Mailhiot	21	Labourer	Third finger right hand bruised while at work in yard.
94	Apr.	23	Asbestos Corp. of Can. Ltd., B.-C Mine.	Art. Larochelle	19	Labourer	In chaining a rock a small stone fell and struck his hand.
95	Apr.	28	Canadian Johns-Manville Co., Ltd.	Aurèle Blanchette	34	Labourer	At work on crushers, small piece of asbestos flew lodging in left eye.
96	Apr.	28	Asbestos Corp. of Can. Ltd., King's Mine.	Alfred Lepage	29	Labourer	Stone fell from jam and crushed his foot.
97	Apr	28	Asbestos Corp. of Can Ltd, King's Mine.	Rosaire Huard	18	Labourer	Struck on left leg by stone.
98	May	2	National Brick Co. Ltd, Delson plant.	E. Boire	18	Labourer	Tripped and fell dislocating ankle.
99	May	2	Canadian Johns-Manville Co., Ltd.	Benjamin Plourde	35	Trackman	Struck by one end of rail that flew up, dislocating of right arm.
100	May	6	Asbestos Corp. of Can Ltd., Beaver Mine.	E. Trépanier	34	Labourer	Pain to left side when caught between door and load.
101	May	7	Asbestos Corp. of Can. Ltd, King's Mine.	Nap. Poudrier	38	Lanourer	Pain in back, struck by stone.
102	May	9	Canadian Johns-Manville Co., Ltd.	Samuel Baxter	34	Labourer	Scraped skin off right wrist while at work with a shovel.
103	May	11	Federal Asbestos Co.	Elzéar Brousseau	36	Carpenter	Finger smashed when caught between crusher shaft and bearing.
104	May	12	Federal Asbestos Co	Jos. Farrell	48	Foreman	Lost sight of one eye, caused by piece of steel flying in his eye.
105	May	12	Federal Asbestos Co.	Stan. Foster	32	Labourer	Rupture of the abdomen by falling off stairs.
106	May	13	Asbestos Corp. of Can Ltd., Beaver Mine	Eug. Ouellet	20	Labourer	Had finger cut between stone and cable-derrick box.
107	May	14	Asbestos Corp. of Can Ltd, B.-C. Mine.	Pierre Chrétien	58	Labourer	Struck his finger on a stone with steel bar in his hand.

NON-FATAL ACCIDENTS 1919.

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injurt
108	May 15	Asbestos Corp. of Can. Ltd., B.-C.. Mine.	H. Vachon.....	26	Labourer.....	While dumping a car he fell and injured his elbow and arm.
109	May 16	Asbestos Corp. of Can. Ltd., Fraser Mine.	Wilf. Paré.....	24	Horse driver.....	Fell from his cart when horse was frightened by dynamite explosion.
110	May 19	Asbestos Corp. of Can. Ltd., King's Mine.	Simon Lavoie.....	35	Labourer.....	Was struck on legs by cable-derrick in motion.
111	May 21	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Alp. Lehouiller.....	29	Labourer.....	Fell and cut his left hand.
112	May 21	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Jos. Bolduc.....	39	Labourer.....	While shovelling into cable-derrick box a stone fell cutting his right hand.
113	May 21	Jacob's Asbestos Mining Co., Ltd...	Wilf. Binette.....	18	Wood picker.....	Put a nail into detonator causing it to explode in his hands, injuring same.
114	May 23	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Alex. McFarland.....	28	Labourer.....	Major finger of right hand crushed when drill fell.
115	May 24	Canadian Johns-Manville Co., Ltd..	El. Lambert.....	20	Repairer.....	While at work in machine shop ran a screw driver into his hand.
116	May 24	Canadian Johns-Manville Co., Ltd..	Joseph Burn.....	27	Foreman.....	Caught leg between tender and engine.
117	May 26	Asbestos Corp. of Can. Ltd., King's Mine.	Francis Oliver.....	27	Labourer.....	Finger broken by rock falling on it.
118	June 1	Asbestos Fibre Mining Co.....	Emile Grenier.....	18	Labourer.....	Ore box swung and hit him on the back.
119	June 4	Asbestos Corp. of Can. Ltd., King's Mine.	Alb. Spenard.....	58	Carpenter.....	Fell on belt planer while working, both legs injured.
120	June 5	Jacob's Asbestos Mining Co., Ltd...	Louis Charretier.....	24	Shoveller.....	While placing cars in drift had right leg broken between cars and locomotive.
121	June 7	Maisonneuve Quarry Co., Ltd.....	Maxime Provost.....	55	Labourer.....	Finger smashed while helping to lift an ore chute in crushing plant.
122	June 7	Canadian Johns-Manville Co., Ltd..	Benjamin Lawrence...	38	Foreman.....	Foot crushed and amputated while getting on car foot slipped and wheel passed over man's foot.
123	June 10	Canadian Johns-Manville Co., Ltd..	Pafnour Kysaarp.....	29	Driller.....	Contusion of right hand finger. Got hand squeezed between rock and drill in pit.
124	June 10	Asbestos Corp. of Can. Ltd., King's Mine.	Frs. Bonon.....	29	Labourer.....	Right hip and back injured when struck by cable-derrick box in motion.
125	June 10	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.....	Donat Gagnon.....	19	Labourer.....	Right leg crushed between a big stone and a loaded cable derrick box.
126	June 11	Asbestos Corp. of Can. Ltd., King's Mine.	C. A. Aucoin.....	43	Labourer.....	Struck on leg by stone falling from jam.
127	June 12	Bell Asbestos Mines.....	Jos. Godbout.....	18	Labourer.....	Hit on hip by big rock rolling from top of jam.
128	June 13	Canadian Johns-Manville Co., Ltd..	Nap. Jutras.....	18	Repairer.....	Finger caught between surface of car and piece of pipe while unloading car of machinery.

129	June	17	Canadian Johns-Manville Co., Ltd..	John A. McDonald....	46	Foreman.....	Foot caught between jack block and jack arm of steam shovel.
130	June	17	Asbestos Corp. of Can. Ltd., Beaver	J. Vaillancourt.....	25	Labourer.....	Struck on hip by stone falling from jam.
131	June	17	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Jos. Naud.....	18	Labourer.....	Cut on head; fell from platform.
132	June	17	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Theo. Boisvert.....	24	Labourer.....	Had elbow strained by pulley, while cleaning shaking screens in mill.
133	June	17	Jacob's Asb. Mining Co., Ltd.....	Alb. Laliberté.....	30	Shoveller.....	Hip and right side squeezed in coupling two cars underground, when draw-bar slid to one side.
134	June	18	Jacob's Asb. Mining Co., Ltd.....	Willie Dubois.....	23	Yardman.....	While unloading brick he bruised his thumb.
135	June	18	Canadian Johns-Manville Co., Ltd..	Frank Martel.....	57	Labourer.....	Sharp point of rail pierced hand.
136	June	19	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Jos. Lessard.....	22	Labourer.....	Stone fell on foot, bruising same.
137	June	19	Asbestos Corp. of Can. Ltd., King's Mine.	Emile Blanchard.....	21	Labourer.....	Struck by stone on leg.
138	June	19	Louis Bertrand, Stone Quarry.....	E. Lyonnais.....	32	Labourer.....	While loading a box, a stone slipped from his hands and fractured a finger.
139	June	22	Asbestos Corp. of Can. Ltd., King's Mine.	Alfred Filteau.....	52	Fireman.....	Burned legs while cleaning boiler tubes.
140	June	24	Asbestos Corp. of Can. Ltd., King's Mine.	Jos. Goulet.....	17	Labourer.....	Rock fell on his thumb.
141	June	26	Jacob's Asbestos Mining Co., Ltd...	Eug. Nadeau.....	36	Sweeper.....	While unloading a rock conveyor had finger bruised between rock and feed spout.
142	June	26	Jacob's Asbestos Mining Co., Ltd...	Geo. Lamiska.....	53	Shoveller.....	While loading a car underground had his hand cut between two rocks.
143	June	27	Black Lake Asb. & Ch. Co., Ltd.,	H. L. Parrish.....	—	Mining Engineer.	Fell about 60 feet down a shaft, fractured arm. Three big cuts on scalp, and was bruised all over his body.
144	June	28	Bennett-Martin Asb. & Ch. Mines, Ltd., Thetford Mine.....	Philippe Boldue.....	35	Labourer.....	While running down rock on a jam, he was struck by stone on ankle.
145	June	28	Bennett-Martin Asb. & Ch. Mines Ltd., Thetford Mine.	Henry Canning.....	26	Labourer.....	Foot injured between a rock and a loaded cable-derrick box.
146	June	28	Canadian Johns-Manville Co., Ltd..	Oscar Poisson.....	21	Labourer.....	Large stone rolled on leg.
147	June	30	Bennett-Martin Asb. & Ch. Mines Ltd., Thetford Mine.	Philéas Gagné.....	45	Labourer.....	Inmoving a large stone he felt a pain in the back.
148	June	30	Bennett-Martin Asb. & Ch. Mines Ltd., Thetford Mine.	W. Grégoire.....	22	Oiler.....	While oiling machinery in mill, had hand caught in a gear.
149	June	30	Asbestos Corp. of Can. Ltd., King's Mine.	Eug. Collet.....	52	Labourer.....	Struck on hand and leg by rock falling from jam.
150	July	2	Bennett-Martin Asb. & Ch. Mines Ltd., Thetford Mines.	Ernest Kirouac.....	28	Labourer.....	Leg contused when caught between side of pit and loaded cable-derrick box.
151	July	3	Jacob's Asbestos Mining Co., Ltd...	Hon. Leblond.....	28	Shoveller.....	While placing cable-derrick box in pit, it fell on his foot bruising it.
152	July	4	Asbestos Corp. of Can. Ltd., King's Mine.	Jos. Lepage.....	29	Labourer.....	Rock fell from jam and struck his leg.
153	July	4	Asbestos Corp. of Can. Ltd., King's Mill.	Alf. Hallé.....	23	Driller.....	Cut on head, foot slipped and fell on track.

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No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
154	July 5	Black Lake Asb. & Ch. Co., Ltd., Asbestos Mine	Elie Daignault	24	Labourer	While working on a pile of loose stones, was caught by one rolling down when trying to get out of its course, leg fractured.
155	July 5	Zinc Company Ltd	N. Mercure	40	Millman	Lead car overturning when dumping into sleigh, crushed foot.
156	July 7	Montreal Crushed Stone Co., Ltd.	L. Charbonneau	20	Oiler	While oiling, clothes caught between one of the rollers supporting screens flesh wound to right arm.
157	July 8	Bennett-Martin Asb. & Ch. Mines Ltd.	Roméo Demers	19	Labourer	While loading a cable-derrick box had leg caught between it and rolling stone.
158	July 8	Asbestos Corp. of Can. Ltd., King's Mine.	Georges Poiré	28	Labourer	Caught finger between crow-bar and rock.
159	July 8	Asbestos Corp. of Can. Ltd., King's Mine.	V. Barbier	28	Labourer	Piece of rock fell on his finger bruising it.
160	July 8	Federal Asbestos Co	Nap. Dulac	22	Labourer	Hurt body under a screen in mill by a piece of iron.
161	July 10	Asbestos Corp. of Can. Ltd., King's Mine.	Jos. Bélanger	36	Carpenter	Particle of dust flew in his eye.
162	July 12	Montreal Crushed Stone Co., Ltd.	Frs. Desormeaux	—	Labourer	Finger smashed when partner let go his hold on heavy piece of timber which they were lifting.
163	July 14	Asbestos Corp. of Can. Ltd., B.-C. Mine.	J. Kerolenzuk	28	Labourer	Was struck on hip and shoulder by cable-derrick box.
164	July 16	Federal Asbestos Company	Od. Gilbert	24	Driller	In setting up a drill, he slipped and fell causing rupture in the abdomen
165	July 17	Bennett-Martin Asb. & Ch. Mines Ltd., Thetford Mine	E. Versey	34	Labourer	While moving large rock he had finger squeezed between two rocks.
166	July 18	Canadian Johns-Manville Co., Ltd.	Z. Tellier	32	Labourer	While at work in slip, fell down to the bottom, and contused arm and hip.
167	July 21	Canadian Johns-Manville Co., Ltd.	John Leroux	37	Labourer	Large stone rolled against his leg from slip in mill.
168	July 21	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Thos. Miotte	30	Labourer	Struck on right leg by cable-derrick box.
169	July 21	Bell Asbestos Mines	Th. Doherty	48	Teamster	Wagon upset, man fell out, one of wheels passed over his left leg.
170	July 22	Asbestos Corp. of Can. Ltd., King's Mine.	Alp. Turcotte	33	Labourer	Piece of rock fell on right foot.
171	July 23	National Brick Co., Ltd., Laprairie Plant.	Nap. Vandal	—	Brakesman	Using crow-bar instead of side brake to stop slow running car. The bar slipped and the wheel of car caused bar to come down on foot with considerable force.
172	July 23	Bennett-Martin Asbestos & Chrome Mines Ltd, Thetford Mine.	H. Bergeron	28	Labourer	While piling up asbestos bags in stores one rolled down and sprained his knee.
173	July 23	Bennett-Martin Asbestos & Chrome Mines Ltd., Thetford Mine.	Jos. Duquette	39	Machinist	In transporting heavy piece of steel it fell on foot, crushing same.

174	July	24	Canadian Johns-Manville Co., Ltd.	Delphis Henri	32	Repairer	While working on locomotive a brake shoe fell and struck his leg.
175	July	25	Asbestos Corp. of Can. Ltd., B.-C. Mine.	A. Lamontagne	18	Labourer	Had fingers bruised between box and casting in mill.
176	July	27	Federal Asbestos Company	Fred. Gagnon	49	Carpenter	Strain of the back in hammering a plate with a cold chisel.
177	July	29	Asbestos Corp. of Can. Ltd., King's Mine.	Jos. Lamontagne	26	Labourer	Struck on leg by rock falling from jam.
178	July	29	Canadian Johns-Manville Co., Ltd.	V. Laprise	33	Locom. Driver	Fell in pit and struck leg on bolt.
179	July	30	Canadian Johns-Manville Co., Ltd.	F. Boutant	28	Driller	While running a drill he saw a stone falling from face where he was working and on running away he fell over into the pit, fracturing skull.
180	Aug.	1	Asbestos Corp. of Can. Ltd., King's Mine	Art. Roberge	22	Labourer	Cut on leg with axe while cutting twine for bags.
181	Aug.	4	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Geo. Lacroix	40	Labourer	Legs and body bruised when he fell from scaffold, 15 feet high.
182	Aug.	6	Asbestos Corp. of Can. Ltd., King's Mine	J. Lafleur	43	Labourer	Struck by cable-derrick box.
183	Aug.	6	Bell Asbestos Mines	P. Roy	58	Labourer	Big stone rolled from jam, bruising left foot.
184	Aug.	8	Asbestos Corp. of Can. Ltd., King's Mine.	Ov. Paquet	28	Labourer	Piece of rock fell on his hand.
185	Aug.	8	Bennett-Martin Asb. & Ch. Mines Ltd., Thetford Mine	Ed. Bergeron	30	Labourer	While loading a cable-derrick box had his finger smashed between two pieces of rock.
186	Aug.	11	Montreal Crushed Stone Co., Ltd.	C. Pelletier	25	Labourer	Helping to pull up bodies of dump cars after load had been dumped, had fingers caught between bottom of door and platform of car.
187	Aug.	12	Quebec Asbestos Corporation	George Raby	48	Steam-shovel	Working in front of steam shovel a rock fell on foot.
188	Aug.	12	Asbestos Corp. of Can. Ltd., Beaver Mine.	C. George	35	Labourer	Was caught by steel plate and had finger cut.
189	Aug.	13	The Pennington Asbestos Co.	W. C. Morrow	25	Labourer	Injured right hand while coupling cars.
190	Aug.	15	Jacob's Asbestos Mining Co., Ltd.	Geo. Stucoff	24	Shoveller	Working at bottom of chute, a rock struck him on ankle and sprained it.
191	Aug.	15	Mutual Chemical Co. of Canada, Ltd.	Arsène Goudreau	24	Shoveller	While loading a stone onto a car his finger was caught between car and stone.
192	Aug.	18	Canadian Johns-Manville Co., Ltd.	Frank Kingley	24	Brakesman	Caught foot between two cars which he was trying to adjust.
193	Aug.	19	Jacob's Asbestos Mining Co., Ltd.	Louis Geraldi	26	Driller	Injured to finger when rock fell from roof of stope after blasting.
194	Aug.	20	Jacob's Asbestos Mining Co., Ltd.	Ovide Gagné	32	Bagger	Sprained his hand in bagging asbestos.
195	Aug.	20	Asbestos Corp. of Can. Ltd., B.-C. Mine.	A. Croteau	20	Driller	Struck side on a pipe.
196	Aug.	21	Asbestos Corp. of Can. Ltd., King's Mine.	W. Dodier	19	Labourer	Was stuck by rock falling from jam.
197	Aug.	23	Jacob's Asbestos Mining Co., Ltd.	G. Sylander	25	Shoveller	In opening chute door to load car, a log caught his left middle finger.
198	Aug.	23	Asbestos Corp. of Can. Ltd., King's Mine.	A. Jacques	52	Labourer	Was struck on shoulder and breast by crow-bar causing rupture.

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No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
199	Aug. 23	Bennett-Martin Asb. & Ch. Mines Ltd., Thetford Mine.	John Lette	40	Labourer	In loading a cable-derrick box, finger caught between, two pieces of rock.
200	Aug. 25	Canadian Johns-Manville Co., Ltd..	Bl Tanguay	41	Trackman	Fell in running to avoid a blast.
201	Aug. 26	Canadian Johns-Manville Co., Ltd..	A. Pelletier	20	Craneman	Hip contused and scalp lacerated when craneman at work on steam shovel was knocked off the boom.
202	Aug. 27	Asbestos Corp. of Can. Ltd., King's Mine.	J. McCutcheon	45	Labourer	Right hand bruised when struck by stone.
203	Aug. 28	Asbestos Corp. of Can. Ltd., King's Mine.	Joseph Gagné	35	Labourer	Left eye injured by flying piece of rock.
204	Aug. 29	Asbestos Corp. of Can. Ltd., King's Mine.	Geo. Seguin	25	Labourer	Sprained his back while loading cable-derrick box
205	Aug. 30	Bell Asbestos Mines	W. Dutil	20	Labourer	Thumb so injured as to necessitate amputation when it was caught between corner of cable-derrick box and chain as it was being hoisted to surface.
206	Sept. 2	Jacob's Asbestos Mining Co., Ltd...	Ernest Nantel	17	Millman	While fixing a spout in the mill he cut his finger on edge of same.
207	Sept. 3	Jacob's Asbestos Mining Co., Ltd...	John Canning	27	Electrician	Back and hip injured from fall caused by slipping ladder.
208	Sept. 5	Canadian Johns-Manville Co., Ltd..	Oscar Boisvert	18	Labourer	Scraped skin off hand while at work.
209	Sept. 7	Federal Asbestos Company	William Grimard	38	Mill Superin't	Rupture of the abdomen when he was trying to lift a shaft in mill.
210	Sept. 7	Asbestos Corp. of Can. Ltd., King's Mine.	O. Gagné	27	Labourer	Injured left hip when moving his drill he fell against a rock.
211	Sept. 9	Canadian Johns-Manville Co., Ltd..	Mederic St. Cyr	28	Craneman	Caught hand in gears of a steamshovel boom while trying to avoid dirt slide in front of steamshovel.
212	Sept. 9	Black Lake Asb. & Ch. Co., Ltd, Asbestos Mine..	Jos. Lemay	22	Box dumper	Foot bruised when it was caught between car and cable-derrick box.
213	Sept. 10	Canadian Johns-Manville Co., Ltd..	L. Geoffroy	43	Blacksmith	Hand caught in power shears of machines shop.
214	Sept. 15	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Herbert Cook	33	Labourer	Foot bruised when rock fell on it.
215	Sept. 16	Asbestos Corp. of Can. Ltd., B.-C. Mine.	G. Cechire	30	Labourer	Rock rolled and caught his finger.
216	Sept. 15	Jacob's Asbestos Mining Co., Ltd...	Jos. Dumais	26	Shoveller	While breaking a stone a rock rolled from the jam onto his foot, injuring same.
217	Sept. 16	Bell Asbestos Mines	Jos. Molien	59	Labourer	Big stone rolling from the jam onto his foot fractured a toe.
218	Sept. 18	Jacob's Asbestos Mining Co., Ltd...	A. Berthiaume	19	Shoveller	When coupling cars underground, man was accidentally caught as one was being backed towards the other by the locomotive for the purpose.

219	Sept.	19	Bennett-Martin Asb. & Ch. Mines Ltd, Thetford Mine.	M. Lambert	27	Labourer	Rupture to abdomen while loading a cable-derrick box.
220	Sept.	20	Asbestos Corp. of Can. Ltd., King's Mine.	Jos. Landry	26	Labourer	Right thumb injured while coupling cars on surface.
221	Sept.	20	Asbestos Corp. of Can. Ltd., King's Mine.	P. Carrier	35	Labourer	Fell on drill, dislocating shoulder.
222	Sept.	20	Bell Asbestos Mines	Clovis McGee	40	Teamster	When loading a piece of square timber onto a truck, he strained his body and ruptured himself.
223	Sept.	22	Jacob's Asbestos Mining Co., Ltd.	J. M. Gilbert	61	Miner	Injured was shovelling in glory hole when a rock rolled on his foot.
224	Sept.	23	Asbestos Corp. of Can. Ltd., B-C. Mine.	W. Bellavance	18	Labourer	Shoulder and chest bruised when falling in ore bin while dumping car.
225	Sept.	24	Asbestos Corp. of Can. Ltd., King's Mine.	Fred. Bergeron	19	Labourer	Cut his finger while loading cable-derrick box.
226	Sept.	24	Bell Asbestos Mines	Oct. Bernard	50	Trackman	While cutting rail alongside of track, the locomotive hit the end of the rail and threw it on his right leg, fracturing same.
227	Sept.	25	Asbestos Corp. of Can. Ltd., Beaver Mine.	G. Pellerin	50	Labourer	While loading a cable-derrick box he slipped and strained his right side, causing a rupture.
228	Sept.	25	Asbestos Corp. of Can. Ltd., King's Mine.	H. Bilodeau	20	Labourer	Cut thumb on sharp stone while loading stone in cable-derrick box.
229	Sept.	26	Asbestos Corp. of Can. Ltd., King's Mine.	L. Lacroix	17	Labourer	Leg injured by stone falling from jam.
230	Sept.	27	Black Lake Asb. & Ch. Co., Ltd., Asbestos Mine.	Alp. Dussault	21	Labourer	Had his thumb caught in ring of cable-derrick box chain and was lifted off the ground.
231	Sept.	27	Asbestos Corp. of Can. Ltd., King's Mine.	Ph. Grégoire	21	Labourer	Piece of rock fell on his foot.
232	Sept.	29	Asbestos Corp. of Can. Ltd., Beaver Mine.	Wm. Metingley	42	Driller	Sprained left knee when he fell against rock.
233	Sept.	29	Carrière de Québec Limitée	Arthur Grenier	52	Labourer	While loading car, rock rolled from jam crushing finger.
234	Oct.	1	Asbestos Fibre Mining Co.	Richard Roy	25	Carpenter	Fingers pinched when bar he was holding caught in machine in mill.
235	Oct.	1	Asbestos Corp. of Can. Ltd.	H. Bergeron	21	Labourer	Left leg injured when struck by cable-derrick box.
236	Oct.	1	Zinc Company Ltd.	J. Thibeault	38	Driller	Injury to eyes and ears; lighting pipe with piece of paper and throwing it on muck pile after holes had been loaded withdynamite, paper catching fuse, caused explosion.
237	Oct.	2	Black Lake Asb. & Ch. Co., Ltd., Asbestos Mine.	Jos. Routhier	21	Crusher tender	Shoulder and neck bruised while tending machine.
238	Oct.	4	Federal Asbestos Company	A. Poulin	67	Labourer	Struck on leg by rolling stone while working in open cast pit.
239	Oct.	4	Canadian Johns-Manville Co., Ltd.	A. Pruneau	27	Brakeman	Fell between bars in tender of locomotive.
240	Oct.	9	The Pennington Asbestos Co.	Nap. Bossé	29	Labourer	While chaining rocks in pit, the chain slipped and caught right hand.
241	Oct.	10	Jacob's Asbestos Mining Co., Ltd.	Jos. Vaillancourt	50	Crusherman	While feeding crusher, he fell bruising right side of body.

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242	Oct. 10	Bennett-Martin Asb. & Ch. Mines Ltd., Thetford Mine.	A. Grégoire	26	Carpenter	A glass pane broke while repairing window, cut to right hand.
243	Oct. 13	Asbestos Corp. of Can. Ltd., Fraser Mine.	A. Landry	26	Labourer	Struck on left hand by stone falling from jam.
244	Oct. 13	Asbestos Corp. of Can. Ltd., King's Mine.	A. Dupuis	18	Labourer	Lost left eye when drill struck dynamite which had not exploded.
245	Oct. 13	Montreal Quarry Ltd.	Noé Lecuyer	40	Labourer	Fractured rib in falling on platform of crusher.
246	Oct. 14	National Brick Co., Ltd., Delson plant.	S. Gagné	40	Labourer	Sprained his ankle while at work in clay track.
247	Oct. 16	Zinc Company Ltd.	Geo. Beaupré	22	Trammer	Running on car and holding side, finger crushed when car passed chute.
248	Oct. 16	Zinc Company Ltd.	R. Ellemond	23	Trammer	Foot crushed by car running over it.
249	Oct. 17	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Wm. Bellavance	54	Labourer	Had finger bruised between crow-bar and door.
250	Oct. 17	Asbestos Corp. of Can. Ltd., King's Mine.	Ovide Cyr	29	Machinist	Piece of rock rolled from jam and struck him on head.
251	Oct. 17	Jacob's Asbestos Mining Co., Ltd.	Mike Bodnar	38	Shoveller	Finger bruised in barring down loose in a glory hole.
252	Oct. 18	Canadian Johns-Manville Co., Ltd.	Jos. Bossé	48	Millwright	Fractured rib when he fell on railway around mill while lifting the railing with air pressure.
253	Oct. 18	Montreal Quarry Rgd.	H. Charbonneau	—	Foreman	Misplaced foot in gearing of electrically driven hoist.
254	Oct. 21	Asbestos Corp. of Can. Ltd., B.-C. Mine.	A. Dubuc	25	Labourer	Cut finger between piece of iron and anvil.
255	Oct. 21	Asbestos Corp. of Can. Ltd., B.-C. Mine.	P. Charland	20	Labourer	Dropped chain on his foot.
256	Oct. 22	Jacob's Asbestos Mining Co., Ltd.	Ph. Martin	17	Shoveller	While loading cars at bottom of chute a rock fell from same and struck him on left leg.
257	Oct. 25	Canadian Johns-Manville Co ,Ltd.	Wm. Morisette	22	Labourer	While working in mill was caught in gears, contusing and lacerating right arm.
258	Oct. 28	Montreal Sand & Gravel Co., Ltd.	Chs. Leblanc	58	Engineman	Was operating on pump scow when engine stopped on centre and when he started it, his coat caught between belt and pulley, was thrown on floor and bruised shoulder arm, also cuts to scalp.
259	Oct. 28	The Megantic & Stanstead Quarry Co., Ltd., Magantic quarry.	Antoine Champagne	40	Stone cutter	High wind fell his machine over him, fracturing ribs.
*260	Oct. 29	Bell Asbestos Mines.	Jean Gagné	61	Labourer	When barring stone he got his thumb jammed between a stone and the crow-bar he was holding.
261	Oct. 30	Asbestos Corp. of Can. Ltd., King's Mine.	Nap. Mercier	53	Labourer	Struck on hip by crow-bar while moving rock.

262	Oct.	30	Jacob's Asbestos Mining Co., Ltd..	Ulric Labarre.....	25	Foreman.....	Jammed between two cars while coupling them. Ribs fractured.
263	Nov.	1	Asbestos Fibre Mining Co.....	Valère Roy.....	19	Oiler.....	Wrist caught between gear and pinion.
264	Nov.	5	Canadian Johns-Manville Co., Ltd.	Antonio Paradis.....	30	Brakeman	Struck by locomotive, cut on chin.
265	Nov.	6	Jacob's Asbestos Mining Co., Ltd..	Jos. Goulet.....	17	Shoveller.....	Was shovelling in an incline shaft when rock fell from the roof striking him on back.
266	Nov.	6	Asbestos Corp. of Can. Ltd., Beaver Mine.	Geo. Nadeau.....	29	Labourer.....	Rock rolled from jam on right leg.
267	Nov.	6	Black Lake Asb. & Ch. Co., Ltd, Caribou Mine.	Paddy Morphet.....	26	Contractor.....	Hit by falling stone, bruises on head, shoulder and leg.
268	Nov.	7	Asbestos Corp. of Can. Ltd , King's Mine.	Alp. Grondin.....	30	Labourer.....	Leg broken when struck by piece of rock.
269	Nov.	9	Canadian Johns-Manville Co., Ltd..	Alex. Desrosiers.....	44	Labourer.....	Finger lacerated when drill fell on hand.
270	Nov.	10	National Brick Co., Ltd., Delson plant	T. Z. Lefrançois.....	27	Labourer.....	Clay car was being dumped, when chain which holds car at an angle gave way and the car tilting over, caught and fractured the man's arm.
271	Nov.	10	Bell Asbestos Mines.....	A. Thibaudeau.....	28	Brakeman.....	In coupling car to locomotive had right leg caught between draw bars.
272	Nov.	11	Asbestos Corp. of Can. Ltd., Beaver Mine.	Henri Gravel.....	34	Fireman.....	Struck to right eye by piece of rock.
273	Nov.	12	Black Lake Asb. & Ch. Co , Ltd., Asbestos Mine.	Alph. Perreault.....	37	Labourer.....	Left leg bruised and scalp wound caused by rolling stone.
274	Nov.	12	Asbestos Corp. of Can. Ltd., B.-C. Mine.	F. Dostie.....	19	Labourer.....	Stone rolling from jam bruised right hand.
275	Nov.	13	Canadian Johns-Manville Co., Ltd..	Thomas Côté.....	50	Driller.....	Piece of rock fell on hand.
276	Nov.	13	Asbestos Corp. of Can. Ltd., Beaver Mine.	Ed. Bourassa.....	29	Labourer.....	Leg broken when struck by rock while unloading cable-derrick box.
277	Nov.	19	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Cl. Jacques.....	26	Labourer.....	Ankle sprained when rock rolled from jam and struck him.
278	Nov.	19	Canadian Johns-Manville Co., Ltd..	Nap. Mailhiot.....	34	Driller.....	Sprained ankle in jumping away from falling rock.
279	Nov.	19	Black Lake Asb. & Ch. Co., Ltd., Asbestos Mine.	Pedro Letouski.....	37	Box tender.....	Finger broken when cable-derrick box fell on his hand.
280	Nov.	20	Asbestos Corp. of Can. Ltd , B.-C Mine.	Thomasso Miotte.....	31	Labourer.....	Had finger caught between rocks.
281	Nov.	21	Jacob's Asbestos Mining Co., Ltd..	Mike Osoko.....	30	Driller.....	Sprain of right foot, while climbing ladder foot slipped.
282	Nov.	22	Wallace Sandstone Quarries Ltd., Missisquoi quarry.....	Adams Gentile.....	33	Quarryman.....	Pelvis injured, jammed between a block of marble and a stump.
283	Nov.	22	Asbestos Corp. of Can. Ltd., Beaver Mine.	D. Vaillancourt	23	Labourer.....	Finger injured when struck by cable-derrick chain in motion.
284	Nov.	24	Bennett-Martin Asbestos & Chrome Co , Ltd , Thetford Mine.	Alfred Roy.....	59	Labourer.....	While stepping off a large block of rock he misplaced his foot, causing sprain.
285	Nov.	25	Canadian Johns-Manville Co., Ltd..	Donat Dosselin.....	20	Labourer.....	While at work around steamshovel, injured finger.
286	Nov.	25	Asbestos Corp of Can. Ltd , B.-C Mine.	Geo. Lacroix.....	40	Labourer.....	Shaft fell of his foot in mill.
287	Nov.	25	Asbestos Corp of Can Ltd., Beaver Mine.	Jos. Paré.....	48	Engineman.....	Had finger caught between car and cable-derrick box.

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288	Nov. 27	Canadian Johns-Manville Co., Ltd..	Colix Nocl.....	35	Repair man.....	While moving a steel span for trestle, pry slipped striking him on the chin and threw him over backwards, head striking rail, fractured skull.
289	Nov. 27	Black Lake Asb. & Ch. Co., Ltd., Asbestos Mine.	Milan Karr.....	27	Box tender.....	Left arm broken when struck by swinging cable-derrick box.
290	Dec. 1	Asbestos Corp. of Can. Ltd., B.-C. Mine.	A. Gagnon.....	19	Labourer.....	Had fingers caught in locomotive in motion.
291	Dec. 2	Asbestos Corp. of Can. Ltd., King Mine.	Ovide Côté.....	19	Labourer.....	Piece of rock fell from jam and struck him on foot.
292	Dec. 2	Asbestos Corp. of Can. Ltd., King Mine.	Jos. Perreault.....	32	Labourer.....	Left leg injured when struck by frozen piece of earth.
293	Dec. 2	J. V. Bélanger Mining Co., Ltd.....	L. Sevigny.....	30	Crusherman.....	Hand caught in belt while tending crusher.
294	Dec. 3	Johnson's Company.....	C. Menard.....	30	Labourer.....	Cover of fiberizer fell on leg, bruising same.
295	Dec. 4	Asbestos Corp. of Can. Ltd., Beaver Mine.	G. Hainse.....	20	Labourer.....	Stone fell on his finger.
296	Dec. 4	Canadian Johns-Nanville Co., Ltd.	Alfred Champagne....	38	Labourer.....	Let wheel fall on foot while carrying it.
297	Dec. 6	J. V. Bélanger Mining Co., Ltd.....	Mederic Gagnon.....	30	Labourer.....	Loading stone on surface when a rock rolled from pile on right foot.
298	Dec. 6	Asbestos Corp. of Can. Ltd., B.-C. Mine.	O. Bourgault.....	42	Labourer.....	Stone rolling from jam struck and bruised right arm.
299	Dec. 8	New Rockland Slate Co.....	James Parker.....	42	Labourer.....	Injured when block of rock sliding and tilting over struck victim
200	Dec. 9	Black Lake Asb. & Ch. Co., Ltd., Caribou Mine.	Emile Caron.....	42	Shoveller.....	Right hip dislocated and fracture of right arm by rock slide.
301	Dec. 11	The Pennington Asbestos Co.....	Alex. Roudjack.....	36	Miner.....	While loading cable-derrick box in pit, foot was caught between the box and a large rock.
302	Dec. 11	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Jos. Paré.....	57	Powderman.....	Was injured to hand and face while spitting fuses.
303	Dec. 11	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Jos. Bellavance.....	28	Labourer.....	Foot caught between locomotive and car.
304	Dec. 12	Asbestos Corp. of Can. Ltd., King's Mine.	Honoré Leblond.....	37	Labourer.....	Piece of rock fell on his finger.
305	Dec. 12	Asbestos Corp. of Can. Ltd., King's Mine.	W. Burns.....	35	Labourer.....	Piece of rock fell from jam and struck finger.
306	Dec. 12	Asbestos Corp. of Can. Ltd., King's Mine.	A. Villeneuve.....	32	Labourer.....	Pain to stomach caused by fall on cable-derrick box.
307	Dec. 14	Jacob's Asbestos Mining Co., Ltd...	L. Turcotte.....	22	Oiler.....	While oiling a bearing near a belt in motion, his feet slipped and he fell striking his left arm on the belt which cut his wrist.

308	Dec.	15	Johnson's Company	W. Morrissette	22	Labourer	Was holding wedge striker missed,his shot but struck injured man on left hand.
309	Dec.	15	Canadian Johns-Manville Co., Ltd.	E. M. Boudreau	42	Foreman	Fell on rock in open cast pit, contusion of left thigh.
310	Dec.	16	Johnson's Company	Ed Ferland	40	Driller	Working on steam feed pipe, opened valve turning steam of foot
311	Dec.	16	Asbestos Corp. of Can. Ltd., B.-C. Mine.	H. Dussault	17	Labourer	Ankle sprained, when foot was caught between belt and hoist house.
312	Dec.	16	Jacob's Asbestos Mining Co., Ltd.	E. Dodier	42	Foreman	While tightening a bolt near a gear in motion, his glove caught in the gears, drawing hand in, crushing tip of fingers.
313	Dec.	17	Asbestos Corp. of Can. Ltd., King's Mine.	Nap. Beauchemin	60	Blacksmith	Back and hip injured in fall while walkingwith drills on his back
314	Dec.	17	Asbestos Corp. of Can. Ltd., King's Mine.	Alc. Bergeron	21	Laborer	Struck on leg by arm of switch.
315	Dec.	17	Canadian Johns-Manville Co., Ltd.	Selwyn Barber	20	Steam shovel op'r.	Infection of right hand, while at work simply scratched his hand.
316	Dec.	17	Bell Asbestos Mines	W. Drouin	20	Box tender	Big stone rolled from chute in mill and hit victim working on lean rock dump.
317	Dec.	18	Bennett-Martin Asb. & Ch. Co., Ltd., Thetford Mine.	Victor Rochette	28	Labourer	While loading cable-derrick box, step into a hole, causing sprain to ankle.
318	Dec.	18	Asbestos Corp. of Can. Ltd., Beaver Mine.	Valère Hainse	52	Labourer	Struck finger on cable-derrick box while loading rock.
319	Dec.	19	Asbestos Corp. of Can. Ltd., B.-C. Mine.	P. Charland	20	Labourer	Stone struck his foot.
320	Dec.	19	Asbestos Corp. of Can. Ltd, King's Mine	Art. Pilon	30	Labourer	Piece of rock fell on finger.
321	Dec.	19	Eastern Mining & Milling Co.	Joseph Legrenier	26	Trammer	Man was instructed to pry stone out of chute and stood on a plank to do so; when stone fell out it hit plank breaking it and threw him over, spraining his ankle.
322	Dec.	20	Johnson's Company	Michel Beaulieu	10	Labourer	While handling rock, another employee allowed a stone to roll on his hand, jamming same.
323	Dec.	22	Weedon Mining Co, Ltd	Jos. Bilodeau	25	Shoveller	While working into chute boulder came down and struck his hand.
324	Dec.	22	Asbestos Corp. of Can. Ltd., Beaver Mine.	Noé Richard	26	Labourer	Rock rolled from jam and struck him.
325	Dec.	23	Eastern Mining and Milling Co. Ltd	Walter Harvey	27	Blacksmith	Was sharpening a drill when piece of hot metal flew up and hit his eye burning the ball.
326	Dec.	24	Bennett-Martin Asb. & Ch. C., Ltd., Thetford Mine	Alphonse Laroche	32	Labourer	While loading a cable-derrick box, a rock rolled on his foot bruising same.
327	Dec.	24	Jacob's Asbestos Mining Co., Ltd	Jos. Noel	40	Mill foreman	Arm injured in removing a belt from a pulley.
328	Dec.	27	Jacob's Asbestos Mining Co., Ltd.	Joseph Giguère	33	Crusher tender	A rock fell on his toe while at work in mill.
329	Dec.	27	Canadian Johns-Manville Co., Ltd.	J. B. Moffatt	38	Foreman	While at work around motor, had hand caught in it
330	Dec.	29	Asbestos Corp. of Can. Ltd., B.-C Mine.	Noe Moore	41	Labourer	While repairing rope piece of wire struck his thumb.

NON-FATAL ACCIDENTS 1919

No.	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Injury
331	Dec. 30	Jacob's Asbestos Mining Co., Ltd..	John Poudrier.....	46	Contractor.....	While placing cable-derrick box in open cast pit, foot caught under box.
332	Dec. 30	Canadian Johns-Manville Co., Ltd..	Raoul Lambert.....	30	Fireman.....	Burned while at work around locomotive, injuries became infected.
333	Dec. 31	Asbestos Corp. of Can. Ltd., B.-C. Mine.	Cyrille Lessard.....	46	Driller.....	Struck on leg by loaded cable-derrick box in motion.

GOLD DEPOSITS AT LAKE DEMONTIGNY, ABITIBI, P. Q.,

By Adhémar Mailhiot (*)

Introduction

** The region dealt with in this report is situated near the head of the Harricana river, in the vicinity of lake De Montigny, at a distance of about 30 miles south of the National Transcontinental Railway, in the county of Temiscamingue. Until recent years the Abitibi region was practically unknown and entirely uninhabited; difficulty of access did not allow of settlers going there to clear the land for farms; until then, there were only the trails of a few explorers or some trappers seeking fur-bearing animals; but, since the opening of the National Transcontinental Railway, considerable interest has been taken in it by both the federal and provincial governments as well as by private individuals, lumbermen, settlers and prospectors. It forms part of the immense clay-belt in the northern portion of the Province of Quebec and Ontario and, from this standpoint, it is a country with a great agricultural future. The portions of this territory so far open to settlement are at present situated along the railway line and the principal rivers. Along the Harricana, the settled part extends as far as lake Malartic. The lots in the townships of Dubuisson and Varsan, around lake DeMontigny are not yet open to settlement.

The present report is the result of field-work in the summer of 1919 in the townships of Dubuisson and Varsan where the first gold deposits were discovered some years ago.

I wish here to express my thanks to my assistant, Mr. Aimé Fauteux and to the prospectors and holders of mining claims in the region, especially Messrs. J. J. Sullivan, H. Legault, A. Dufour, Robert and Alfred Clark and others for their courtesy towards me and the many services they rendered me in the performance of my work.

* Professor of Geology at Ecole Polytechnique, Montreal.

** Translated from the French.

Geographical Situation and Means of Communication

The gold-bearing region of lake DeMontigny is situated in the townships of Dubuisson and Varsan, county of Temiscamingue, Province of Quebec. The nearest railway station is at Amos, on the National Transcontinental Railway, 433 miles west of the city of Quebec and 141 miles from Cochrane, Ontario. From Amos, the district in question is reached by ascending the Haricana river, which is navigable for gasoline launches and small steamers from the railway line to about 30 miles beyond the mining camps. Amos is situated about 40 miles from lake DeMontigny and, along its course, the river widens out into three distinct lakes: lake Figuery (or Peter Brown) on the north; lake Lamothe (or Jack Pine) and lake Malartic (or Seal's Home) further south. The branch of the river connecting lake Malartic with lake DeMontigny (formerly Kiénawisik) was called the Askigwaj river. The land along the Harricana river and as far as lake DeMontigny is low-lying and but little broken. It is covered with a thick layer of stratified clay deposited on the bottom of a vast post-glacial lake which occupied the entire northern region of Quebec and Ontario after the disappearance of the pleistocene glaciers. As the valley of the Harricana river is very suitable for cultivation, owing to this layer of clay, the Quebec government has promoted the settlement of this region during the past five or six years.

The whole of this district lies near the water-shed and drains into James Bay through a chain of lakes and the Harricana river.

Previous Explorations and Studies

In the summer of 1906, Mr. W. J. Wilson made a geological investigation of the land along the projected National Transcontinental Railway, the Bellefeuille, Villemontel and Harricana rivers and of the shores of lakes Lamothe and Kewagama. The results of Mr. Wilson's work were published in the Summary Report of the Geological Survey of Canada for the year 1909 and with more details in 1910 in Memoir No. 4 intitled: "General Reconnaissance along the National Transcontinental Railway in Western Quebec." Geological Survey, Department of Mines, Ottawa.

In 1910 and 1911, Mr. M. E. Wilson made a geological inves-

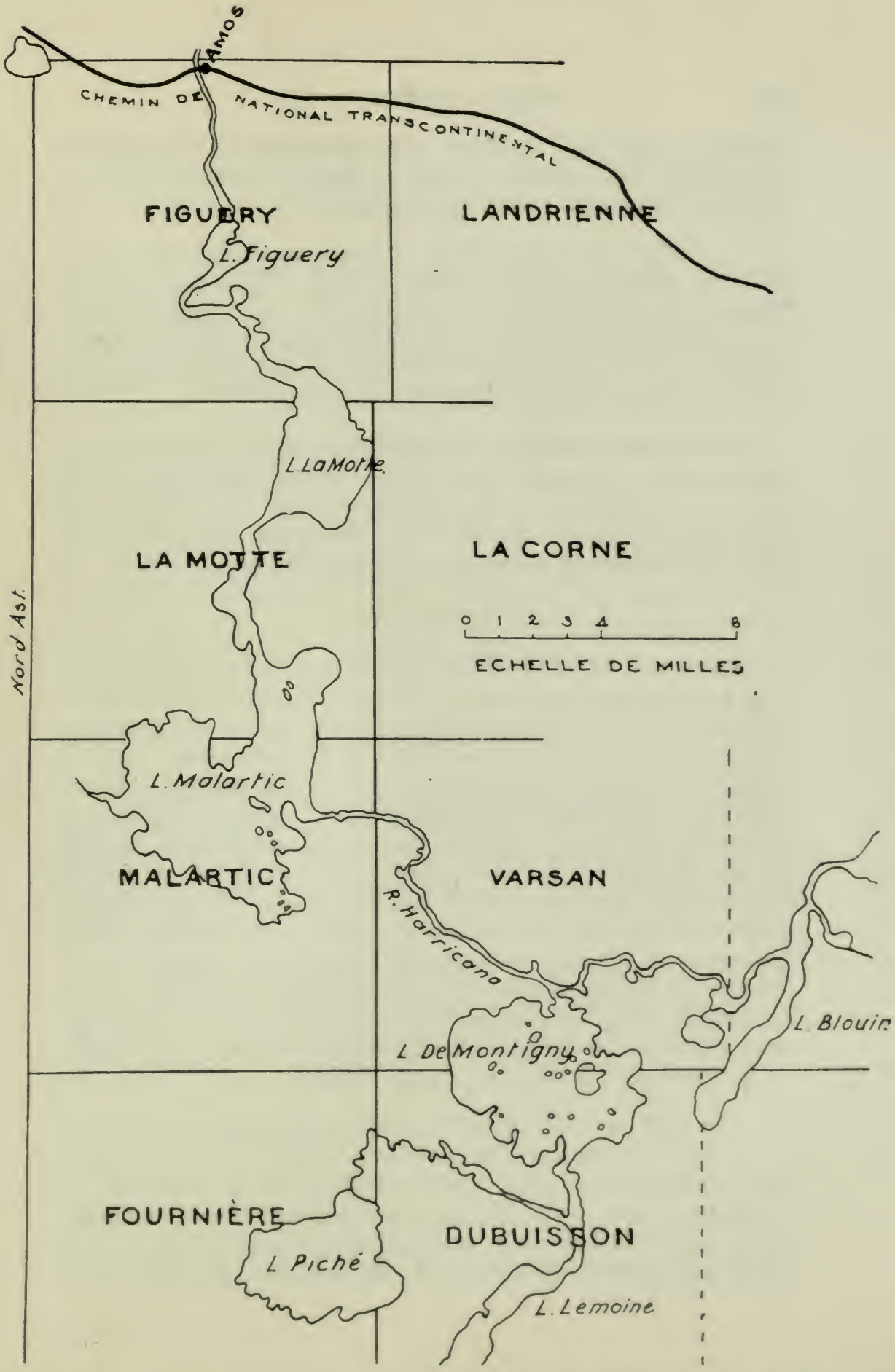

Fig. 2.—Index map showing DeMontigny Lake and Transcontinental Railway.

tigation of the lands adjoining lake Kewagama and published results in Memoir No. 39 of the Geological Survey of Canada, entitled: "Kewagama Lake Region, Quebec."

In 1912, Dr. J. A. Bancroft, made a geological exploration along the Harricana and Nottoway rivers, to the north of the National Transcontinental Railway and also an investigation of the land in the environs of lake Kiénawisic (now lake DeMontigny). These studies were published in the "Report on Mining Operations in the Province of Quebec during the year 1912."

In 1914 and 1915, Mr. T. L. Tanton of the Ottawa Geological Survey made a geological reconnaissance of the region between the Harricana and Turgeon rivers north-east of lake Abitibi and published in 1919, Memoir 109 of the Geological Survey, entitled: "The Harricana-Turgeon Basin in Northern Quebec."

Topography

Taken as a whole the chief characteristic of the Abitibi region is an absolute monotony and its features are identically the same throughout the vast extent of the northern part of the provinces of Quebec and Ontario on each side of the water-shed. It is a succession of undulating plains gradually on the north or on the south to a water-shed separating, in no marked degree, the waters flowing towards Hudson Bay from those flowing towards the St. Lawrence. In this country, without relief or defined general slope, an impermeable sub-soil formed of very ancient rocks, worn down by long periods of erosion and glaciation, retains the waters in a series of innumerable lakes and winding rivers. Post glacial lacustrine clay covers the low parts uniformly, while, in the high parts, the ancient rocks generally appear as outcrops. Here and there rocky knolls break through the clay, the highest rising barely 200 feet above the surroundings.

The region of the southern part of the township of Varsan is very low and swampy, while that of the southern part of the township of Dubuisson is higher and has some of the rocky knolls just described such as on the Neveu, Clark, Legault, Stabell and other claims. Still further south, on the shores of lake Lemoine, rocky knolls are frequently noted. As a rule, the region is rather badly

drained especially in the southern part of the township of Varsan and the tongue of land separating lakes Blouin and DeMontigny, in the township of Dubuisson, where peat-bogs and swamps abound.

The rivers and streams are sluggish and the waters are more or less muddy, owing either to light clay in suspension or to the vicinity of the swamps draining into them. The Askigwaj river is bordered along nearly its whole length by swamps, all more or less open, extending a mile or more inland in some places.

The waters of lake DeMontigny are at an average elevation of 985 ft. above sea-level and flow towards James Bay on the north. The water-shed is rather badly defined and forms a more or less sinuous curve; it runs to the south of lake Lemoine, some fifteen miles south of lake DeMontigny, then turns to the north to pass between lake Malartic and lake Kewagama; the waters of the latter flow into the Ottawa river on the south, while those of lake Malartic flow northerly by the Harricana river.

General Geology

Until late years, Canadian geologists were dividing the complex rocks constituting the precambrian base into two formations: the Keewatin and the Laurentian; the former comprising the whole of the basic metamorphosed rocks and the latter all the intrusive granites and gneisses.

The recent geological reports of Dr. M. E. Wilson, Mr. T. L. Tanton and others have, however, shown that the rocks which had been classified as belonging to the Keewatin formation, probably comprise several distinct series of rocks, several being distinct lava flows and also the existence of granites of different ages. For this reason, we do not think that, as regards the lake DeMontigny region, we should adopt the definitions of the terms "Keewatin" and "Laurentian," as proposed by the International Geological Commission for the lake Superior region. We will thereupon adopt, for the rocks we are now dealing with, the following classification proposed by Dr. M. E. Wilson in his Memoir No. 103,

published by the Ottawa Geological Survey and entitled: "Temiscamingue County, Province of Quebec":—

Pleistocene.—Stratified clays.

Unconformity.

Pre-huronian.—Granodiorite, syenite, quartz porphyry.

Igneous contact.

Precambrian	Abitibi group	Pontiac series	Mica schists and hornblende schists.
		Volcanic Abitibi rocks.	Chlorite schists (green rocks) Diorites, andesites, gabbros, basalts, diabases, peridotites.

PRECAMBRIAN

Abitibi Group

Abitibi volcanics:—This name designates a complex of rocks whose origin is not always very clear. They represent the oldest series known in the lake DeMontigny region. Most of the rocks of this period are of igneous origin; it is probable that some of them, are, nevertheless, of sedimentary origin, but their detritic character has been completely destroyed by metamorphism; as to the igneous rocks, their compact character has frequently disappeared; among the most massive of these, the basalts of amygdaloidal structure, the serpentines (peridotites) the diorites and gabbros may be mentioned. As a general rule, in the region under consideration, the rocks of the Abitibi group have lost their original character through the alteration of the primary minerals such as the feldspars, pyroxenes, amphiboles, into secondary minerals such as epidote, talc, serpentine, chlorite and magnesian carbonates; through the development of schistosity due to dynamometamorphic action, these rocks have assumed some aspects very different

from their original character. Thus those designated as "green rocks" are products of the alteration of basalts, gabbros, etc., or even of sedimentary rocks of very different origin.

The rocks constituting the series of "Abitibi Volcanics" were subjected after their consolidation to intense chemical and dynamic phenomena which explain the very complete transformations of the original rock, the very general development of schistosity and the fissility of these old rocks which are, among all the rocks of the region, those which have been most cut by mineralized veins. In the lake DeMontigny region, the gold-bearing deposits are in the rocks of the "Abitibi group."

We here classify the Abitibi volcanics in two groups: in the first we study the rocks of purely volcanic origin whose compact character has been sufficiently retained to allow of the determining the mineralogical composition or kind under study; this class comprises—in the order of their decreasing acidity—the diorites, andesites, gabbros, basalts and peridotites; in the second group, we include the green rocks or chlorite schists of doubtful origin and whose original characters it is practically impossible to determine.

Diorites and andesites.—The only place in the district where we found these rocks, is in the north part of Siscoe island where the "C" and "D" shafts of the Siscoe Mining Syndicate are situated. The diorite on Siscoe island is a gray or green rock of a more or less fine texture. Andesite, which is the extrusive equivalent of diorite—is also a grayish or greenish rock of porphyritic texture. As a rule these rocks are rather massive but they are also very schistose sometimes. Owing to the alterations undergone by the rocks, it is difficult to determine the nature of their component elements without the aid of a microscope, but epidote, a product of the alteration of feldspar, is easily recognized with the naked eye by its greenish yellow colour.

The thin sections of diorite examined by us under the microscope are formed of a plagioclase feldspar, closely related to oligoclase, much altered into sericite, epidote and calcite, and hornblende-amphibole partly altered into actinolite. There are also some other minerals present such as magnetite and chlorite

The andesites are formed of phenocrysts of plagioclase feldspar embedded in a matrix of microlites of feldspar and amphibole. The prevalent products of alteration are chlorite and epidote, as in the case of diorites.

Gabbros, diabases, basalts and peridotites.—The volcanic rocks interstratified with the green chloritic schists are also green-coloured rocks, but they are easily distinguished from the latter by the size of the component minerals and the texture; the gabbros are coarse grained, consisting of lime-soda feldspar, diallage pyroxene, and hornblende, all these minerals being allotriomorphic in shape; the diabases are generally fine grained and ophitic in structure, while the basalts are formed of microlites showing an aphanitic texture. It is impossible to determine the boundaries of each of these layers on the ground; they gradually pass from one to the other leading to the belief that they belong to the same intrusion, the rim of which was basalt, while the gabbro and diabase occupied the central parts where they cooled more slowly.

The constituents of these rocks are greatly decomposed. The feldspars have been almost entirely altered into sericite, epidote and calcite; the original diallage has been partially transformed into hornblende in the middle of which unaltered cores are sometimes observed. The interstices between the feldspars and the secondary hornblende, or augite, are filled with actinolite or chlorite. These minerals, products of alteration, give a green tint to the rock. In the basalts the matrix is formed of an infinite number of feldspar microlites, lath shaped, lying in a net work.

These rocks form isolated patches connected with the chloritic green rocks. The diabases and gabbros are found particularly on the Neveu, Craft, Foisie-Kengrow and Clowse claims, while the ellipsoidal basalts are more numerous and are found pretty much through the region; the clearest outcrops are on the claim of the Martin Gold Mining Company, Ltd, and on the Clowse claim.

Peridotite is not often found in the lake DeMontigny region, but we came across it in two places, on the two islands on the survey line between ranges IX and X of Dubuisson township directly

south of Siscoe island, and along the Askigwaj river, about two miles from lake Malartic. This rock, usually unweathered is almost entirely altered into serpentine. In connection with this rock we found a small vein of picrolite and calcite. Under the microscope this rock seems to be chiefly formed of olivine partially or wholly altered into serpentine, hornblende and augite, with some black grains of magnetite.

Ellipsoidal structure.—The old lava flows of this region, as, found near the shaft of the Martin Gold Mining Company, Limited, on the Clowse claim, in the immense area south of the Legault and Stabell claims, lots 50 to 58, range VIII of Dubuisson township and at many isolated points, show ellipsoidal structure. The dimensions of the ellipsoidal masses of basalt and andesite vary from a few inches to a couple of feet in length. The outlines of these "pillows" are easily seen at the surface owing to the weathering which has been more active and effective on the substance filling the interstices. This is made up of carbonated and silicious products the real origin of which it is practically impossible to determine. Some geologists, who have studied these rocks in other parts of the country, think that they are sedimentary substances, deposited between the ellipsoidal masses, while others are of opinion, with more reasons perhaps, that the filling consists of some lava substance deposited around the "pillows" after they became solid. These rock "pillows" are not regular in shape; they are more or less elongated, always in the same direction for the same flow and, moreover they are usually flattened on one side.

Green chloritic schists.—Under this head, we describe a series of green-coloured rocks of doubtful origin and very frequently found in the region interbedded with the eruptive rocks described above. These rocks are very often observed around lake De-Montigny where the waves have carried away the clayey soil on the surface. From a mineralogical standpoint they show a great analogy with the basalts but they have not the ellipsoidal structure. They may be old consolidated volcanic ashes that have become schistose by dynamometamorphism. The passing of green schists into ellipsoidal basalts is gradual and without any clear transition.

Pontiac Series.—This series occupies a vast area in the southern part of Dubuisson township; the northern contact with the Abitibi volcanics follows an approximatively N. W. and S. E. direction and crosses Lake Lemoine on lot 38, range VI of Dubuisson township; to the West of Lake Lemoine, the contact follows the Thompson river whose north bank is formed of Abitibi volcanics and the south bank of rocks of the Pontiac series.

This Pontiac series comprises biotite and hornblende quartzose schists. Sometimes these rocks have a gneissic rather than a schistose appearance. Near the contact with the greenstones the schist sometimes passes into a conglomerate the large constituents of which have been drawn out, as in the locality adjoining the Clowse and Goujard claims, lots 46 to 50, range VI of Dubuisson township. The series is cut in many places by dykes and small very irregular masses of granite. In the northern part of the strip, there are lenticular masses and irregular lodes of dark smoky quartz, running parallel to the schistosity.

Dr. J. A. Bancroft, who examined this rock under the microscope, gives the following description of it: "The most prevalent rock-type of the Pontiac Group is a quartzose-biotite schist, but different bands within the series are very variable in appearance, chiefly because of the relative amounts of biotite and hornblende present. In thin section under the microscope, the specimens of these rocks examined were found to be composed chiefly of quartz, biotite and hornblende with a few small grains of black iron ore and pyrite. Biotite is much more abundant than hornblende, very often being present to the exclusion of the latter. Very frequently the biotite is characterized by the presence of dark pleochroic spots within it. Some of the bands contain grains of plagioclase and orthoclase. Within any specimen the majority of the grains of quartz (and feldspar if present) are of about uniform size, forming a mosaic within which the parallel arrangement of the biotite and hornblende imparts the schistose appearance to the rock. Occasionally a few small crystals of tourmaline are present." (1)

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(1) Dr. J. A. Bancroft, Report on Mining Operations in the Province of Quebec for the year 1912 page 211.

Pre-Huronian.—We attribute to this geological stage the acid igneous masses that have clearly intruded through the rocks of the Abitibi groups. These masses, which are rather rare in the region investigated, cover but small areas as a rule. The principal kinds of rocks in this group are granodiorite, syenite and quartz-porphyry.

Granodiorite.—This rock covers an area of about a quarter of a square mile on the present site of the Sullivan claims, lot 53, range X, lots 48, 49, 50 and 51, range IX, Dubuisson township.

The texture of the rock varies considerably; it is sometimes holocrystalline and sometimes gneissic. Under the microscope it appears to be made up essentially of orthoclase and plagioclase feldspar, a little quartz and products of alteration such as chlorite and grains of iron ore. The chlorite, which is particularly abundant, comes from the decomposition of hornblende and biotite.

Syenite.—The only locality in the lake DeMontigny region where this rock has been found, is on the Marsil claim, lots 39 and 40, range I of Varsan township. This rock lies in parallel bands separated by quartz stringers. These bands of syenite crop out on the lake shore in a small bay east of Siscoe island. The rock contains small grains of iron pyrites sometimes in cubes. Under the microscope this rock seems to consist almost solely of albite feldspar with a little quartz and small quantities of rutile, iron pyrites, and zircon. The albite shows splendid twinning according to both carlsbad and albite laws and contains many inclusions of sericite and rutile.

Quartz Porphyry.—These rocks are met with in the shape of dykes cutting all the rocks previously described and consequently constituting the last igneous intrusion of the region. The dykes are rather abundant in the lake DeMontigny region; they are found in nearly all the mining claims. Sometimes they cut the pre-huronian acid rocks just described; thus, on the Sullivan claims, in a rocky point at the northern end of the claims, right on the northern end of the claims, right on the lake shore there is a dyke of quartz porphyry cutting the granodiorite. Elsewhere, they

penetrate the rocks of the Abitibi group as in the claims of the Martin Gold Mining Company, Limited, 50 feet to the west of the principal vein on the property; in the Siscoe claim, at the contact with a vein of goldbearing quartz at the "B" shaft; on the Legault claim a porphyry dyke cuts the andesites and greenstones; on the Stabell claim, a porphyry dyke cuts the green schists and runs along the principal vein of this property.

From a mineralogical standpoint, these dykes, as seen in hand specimens, are formed of large phenocrysts of feldspar and quartz in a matrix of very fine grain. The general colour of the rock is greenish gray, a colour due to the alteration products, such as chlorite. Under the microscope this matrix is seen to be composed of an infinity of microlites of feldspar and hornblende. The phenocrysts of microcline feldspar and albite are mostly altered into kaolin, sericite and calcite. The quartz is the only unaltered constituent of the rock and is never found in great abundance in the thin sections.

Pleistocene.

During the glaciation by continental glaciers at the beginning of the pleistocene period, an immense layer of gravels, sand and boulder clay was deposited on the irregular surface of precambrian rocks. The rocky eminences of the Lake DeMontigny region have a rounded or moutonnée appearance. The slope of the polished rocks is more gentle on the north and more abrupt in the south side, thereby indicating that the glaciers were moving from north to south. The glacial striae and grooves are often well conserved on the surface of the more resistant rocks. The strike of these striae varies from N. 28° E. to N. 25° W. There are often two series of striae at the same spot. Thus, on the rocky point of the Sullivan claim, on the east shore of lake DeMontigny, there are two series of well defined striae: the strike of the first and oldest is N. 28° E. while that of the second and more recent is N. 5° W. The striae of the first glaciation are almost entirely effaced. They are seen only in the depressions of the rock, where they have been spared by the second glaciation which moved in a N. 5° W. direction. At this spot it may be observed that the visible grooves of the first glaciation are more pronounced and

deeper than those of the second. Thus the grooves of the first series are sometimes an inch wide, while those of the second are always very narrow. The striae are easily seen along the whole lake shore wherever the rock outcrops, and also on the islands in the middle of the lake.

The stratified clays occupying nearly the whole of the lake DeMontigny region are of lacustrine origin. In some places the stratification of these tenacious clays is accentuated by an alternation of red layers and gray layers. At the period of glaciation which affected the whole northern part of North America, the preglacial rivers falling into Hudson Bay had ceased to exist; but when the climate grew milder and the ice sheet had withdrawn beyond the watershed, the waters from the melting glaciers were united and formed a lake between the watershed and the receding glacier. Dr. A. P. Coleman, of the Geological Department of Toronto University has named this lake Ojibway. (1)

The horizontal surface of the plain, as it now exists corresponds to the old bottom of this lake Ojibway. The clays covering this bottom were deposited in the deepest parts of the lake. These stratified clays, formed by the muddy waters of the lake, came from the rehandling of the boulder clay and from the powdered rocky substances carried down by the streams from the front of the receding glacier.

These clays very often contain calcareous concretions generally flattened in the shape of disks, but very irregular at times. These concretions are usually flat; some have a hole in the centre, others are crescent shaped. Sometimes neighbouring concretions have become stuck together during their formation. Dr. J. A. Bancroft, in his report of 1912 says: "It seems probable that these limestone boulders contributed much of the calcareous material which solutions deposited along the planes of stratification in the form of these concretions. Although more or less irregularly scattered, through the clay, the concretions are usually much more numerous along certain planes than others, their distribution

(1) Lake Ojibway.—Last of the great glacial Lakes.—A. P. Coleman.—Report of the Ontario Bureau of Mines 1909. Vol. XVIII—1st part.

apparently being at least in part dependent upon the relative impermeability of the thin layers upon which they rest." (1)

Economic Geology

Discovery of the Gold.—The first gold discoveries in the lake DeMontigny region date from 1911. On the 11th July of that year, Messrs. J. J. Sullivan and Hertel Authier discovered gold on the east shore of lake DeMontigny in a quartz vein which has become vein No. 1 of the Sullivan property. The discovery became known only near the end of the fall of that year and a great many prospectors were attracted to the region. In the same year two gold-bearing veins were discovered on the property now owned by the Martin Gold Mining Company Limited. In the following year (1912) two other veins were discovered in the region. One, the Smith vein, at some distance south of lake DeMontigny, which was staked by different persons after its discovery and now belongs to Mr. Geo. Neveu is situated on lots 44 and 45, range VIII Dubuisson township. The other, the Benard vein, now owned by Mr. Tancrède Marsil, is situated on lot 39, range I, Varsan township. In 1915, on Siscoe island, the largest in the lake, gold-bearing veins were also discovered on the claims now belonging to the British Minerals Corporation, Limited. Besides the work done on the island by the Siscoe Mining Syndicate and on the Martin property, where development work has been done and a mill has been put up, very little prospecting was done during the war. Since the signing of the armistice, a great many prospectors have gone to the region around lake DeMontigny and have made discoveries; among which the following may be mentioned: the Stabell, Legault, Parker, Clowse, Caron, St. Germain, Gale, Craft, Foisie-Kengrow and some others.

General Characteristics of the Deposits.—The gold is found in quartz or pegmatite veins in which tourmaline is sometimes found in rather considerable abundance; also a little calcite, iron pyrites and chalcopyrite, scheelite, blende and galena and stibnite.

Tourmaline abounds in nearly all the veins of the Sullivan

(1) Dr. J. A. Bancroft. Report on Mining Operations in the Province of Quebec during the year 1912, page 178.

claim. In some places this mineral constitutes nearly the whole filling of the veins. It is also found in abundance in veins "C" and "D" of the Siscoe Mining Syndicate's claim; and in the Marsil vein. Elsewhere, on the other claims of the region, tourmaline is merely a mineralogical accident.

Calcite is rare in the veins of the region and we found it in one place only, in vein No. 2 of the St. Germain-Gale claim.

Iron pyrites is present in all the veins of the region. It is sometimes found in rather great abundance in the walls. Thus the granodiorite in the Sullivan claims, near the veins, sometimes contains pyrite cubes whose sides measure as much as four inches. In the Marsil claim the syenite bands alternating with the quartz veins contain pyrite grains and cubes in inclusions in the rock. The pyrite in the Sullivan claim, as well as that in the Marsil claim are gold-bearing. An assay of the syenite from the latter claim, made at the Provincial Government Laboratory, gave $4.60 of gold to the ton. When the veins penetrate the green rocks the latter always contain pyrite disseminated in cubes at the contact of the vein.

Chalcopyrite is rare in the region and barely a few small grains are found scattered in the iron pyrites.

We found scheelite or tungstate of lime in vein "C" of the Siscoe claim. This mineral forms small masses or grains in the veins of quartz and tourmaline. Scheelite has also been found in the Martin vein.

Blende and galena are found from time to time associated with the iron pyrites. We found some in vein No. 1 of the Sullivan claim and in the vein of the Parker claim.

We found stibnite at a single place in this region, namely: on the Foisie-Kengrow claim, where this mineral, in the shape of steel-gray needles, is associated with pyrite.

The quartz veins present themselves under very different aspects from one claim to another; sometimes they are almost rectilinear veins with clearly defined walls as in the case of the

principal vein of the Martin property, sometimes the quartz forms irregular veins abruptly widening out into lenses and disappearing by pinching out or forking out into thin stringers as occurs in the veins of the Sullivan claim running across the granodiorite; sometimes the quartz penetrates into the schist in parallel stringers giving the rock a banded appearance, while the outcrop surfaces take on a wrinkled aspect due to the uneven wearing out of the various parts; lastly, the stringers sometimes form parallel bands through an igneous rock as in the Marsil vein, where the veinlets run through the syenite. When the veins cut the schists, the relations between the trend of the veins and that of the enclosing schists is not always easy to determine. Throughout the whole, the quartz veins only partially follow the direction of the schistosity. As a rule, the schistosity is parallel to the walls, when right against the veins.

Originally the whole district was occupied by greenstones and basalts constituting the Abitibi group. Then an intrusion of porphyry, forcing its way through these rocks, had the effect of breaking and shearing them. When the silicious solutions or vapours afterwards sought a way through the rocks, they found a particularly easy outlet in this corrugated and fissured zone which was all the more permeable through being more decomposed. It was the same with the sulphurated auriferous vapours.

The gold is present in two states: as free gold in the massive quartz or in the walls in the vicinity of the vein; or in a combined state dissolved in the iron pyrites.

The Origin of the Gold.—It is a characteristic fact in connection with all the veins of the region, that native gold is often found in the fissures running through the quartz; these fissures are undoubtedly secondary and were filled after the quartz had solidified. The auriferous solutions had in some cases to follow the walls of the veins, since, at one locality, Sullivan's vein No. 7, we noted the presence of native gold in the granodiorite forming the walls about two inches from the contact with the quartz. The gold-bearing veins also frequently contain, in more or less abundance, tourmaline which is a mineral essentially characteristic of magmatic emanations. The fact of some veins being found directly associated with granodiorite, leads us to conclude that

they were formed in the same manner as dykes of pegmatite. In his report of 1912, Dr. Bancroft states that:—"The greater abundance of tourmaline along what were formerly planes of fracture within the quartz, implies that tourmalization continued long after the crystallization of the major part of the quartz. Within some of the veins on Sullivan's claim, a breccia composed of quartz and small altered fragments of the country rock (granodiorite) possesses a matrix of tourmaline with very little quartz." Further on he continues:—"As to origin these veins are closely related to pegmatite dykes. In a sense they are intermediate between pegmatite dykes and true fissure veins. They were formed during the final stages of the cooling down of the granite that invaded this region in the form of batholiths, irregular bosses and dykes. That they originally were formed at great depth is evidenced by the geology of the region, which makes clear that they have been exposed by most profound erosion. They represent the result of prolonged exhalations of vapours and highly heated solutions attending the crystallization of the interior portions of the bodies of granite. The granodiorite (a phase of the granite) on Sullivan's property, which is traversed by a remarkable display of small quartz-tourmaline veins, some of which carry gold, contains very much less quartz than exposures of otherwise similar rocks toward the southern end of Blouin lake and in places in the vicinity of the first group of rapids on the river leading from this lake to Atikamek lake. No quartz veins of any importance were observed in these localities were quartz is an abundant constituent within the granodiorite. This suggests that during the solidification of the granodiorite on Sullivan's claim, the crystallization of the quartz was deferred somewhat, thus increasing the acidity of the still uncooled interior portions of the plutonic body of magma. In this sense the quartz veins may represent the siliceous extreme of the cooling magma, which at that time emanated from depth in the form of highly heated solutions and vapours carrying quartz, tourmaline, etc."

The quartz in the veins is usually white or gray in colour; the native gold is concentrated chiefly along the black streaks in the quartz; these streaks are, as a rule, short and very irregular; gold is nearly always accompanied by sulphides and tourmaline; it is also found in isolated particles in quartz where there is an

absence of fissures and even in the walls of the vein as in the granodiorite of the Sullivan claim. Gold particles have even been found completely enclosed in tourmaline masses containing no quartz. Consequently the close association of native gold with tourmaline in some veins clearly shows that these two minerals have the same origin, namely: pegmatitic origin, and that the solutions producing them were at a high temperature.

The intrusions of acid rocks, such as granodiorite, syenite and porphyry, caused the fractures in the rocks of the Abitibi group. When the main granitic mass was solidified by cooling, the volatile elements of the igneous magna escaped by the pre-existing fractures and formed pegmatite dykes and quartz veins. The formation of these dykes was effected slowly and in some cases (vein No. 4 Sullivan), the primary quartz was ground over again and minerals (gold amongst others) were deposited in the new fractures; but the whole sequence of the phenomenon results essentially from the granitic intrusion.

The depositing took place at a high temperature and at great depths. If the veins now outcrop it is due to phenomena of erosion which have not ceased to act since the remote period of their formation.

Superficial Alteration of the Lodes.—The present state of the work done in the region which has nowhere been carried down below 125 feet (Martin mine) does not allow of any statement being made regarding the value at greater depths, but it may nevertheless be reasonably admitted that the surface conditions will continue down to a depth of several hundred feet. In reality there is neither any oxidation zone (iron capping) nor cementation zone in the region. Glacial erosion has smoothed down the surface over the whole district and the upper oxidized parts of these lodes have disappeared. When the clay covering the lowlying parts of the country is removed, one always finds unweathered fresh rocks. In the higher parts, denuded and subjected to weathering, the alteration zone does not go lower than a few inches below the surface; a sufficiently long time has not elapsed since the glacial period to produce deep decompositions. Nevertheless it is possible as a rule to remove the decomposed rock for a few inches and sometimes a very large proportion of gold will be found by panning.

Description of the Gold-bearing Deposits

Sullivan claims. — These claims are situated on the eastern shore of lake DeMontigny, about four miles to the southeast of its outlet; they occupy the west part of lot 53, range X and the north part of lots 48, 49, 50 and 51, range IX, Dubuisson township, forming an area of 240 acres including the parts adjacent to the lake to the west and south on the mainland.

At this place Messrs. J. J. Sullivan and Hertel Authier, on the 11th July 1911, made the first discovery of gold in this region within a quartz vein outcropping on the shore of the lake, which is described further on under item Vein No. 1.

Upon this claim there is a rocky knoll, about 60 feet in height above the level of the lake, and forming the point projecting into the lake. This knoll is about 1500 feet in length in a north to south and from 500 to 600 feet in an east to west direction. The layer of clay over its surface is comparatively thin. To the south and east, the solid rock sinks down under a considerable depth of loose soil forming a low and swampy area.

The rock massif consists essentially of granodiorite which is an intermediate stage between granite and diorite. It is a semi-holocrystalline rock containing large phenocrysts of feldspar aligned in a constant direction and giving the rock a gneissic appearance. Under the microscope, this rock is seen to be essentially formed of orthoclase and plagioclase feldspars, a little quartz, and alteration products such as: chlorite and grains of iron ore. The chlorite, which is particularly abundant, comes from the decomposition of hornblende and biotite.

The granodiorite is cut by a dyke of syenitic porphyry with strike N. 35° W., and of an average width of 10 feet. This dyke outcrops at the northern end of the point on the shore of the lake. When the water is low, the two walls of this dyke can be seen. At this spot, the granodiorite contains an inclusion of greenstone of the Abitibi group, about four feet in diameter which is itself cut by the porphyry dyke. The latter is again found about 600 feet southeast of the western extremity of vein No. 1.

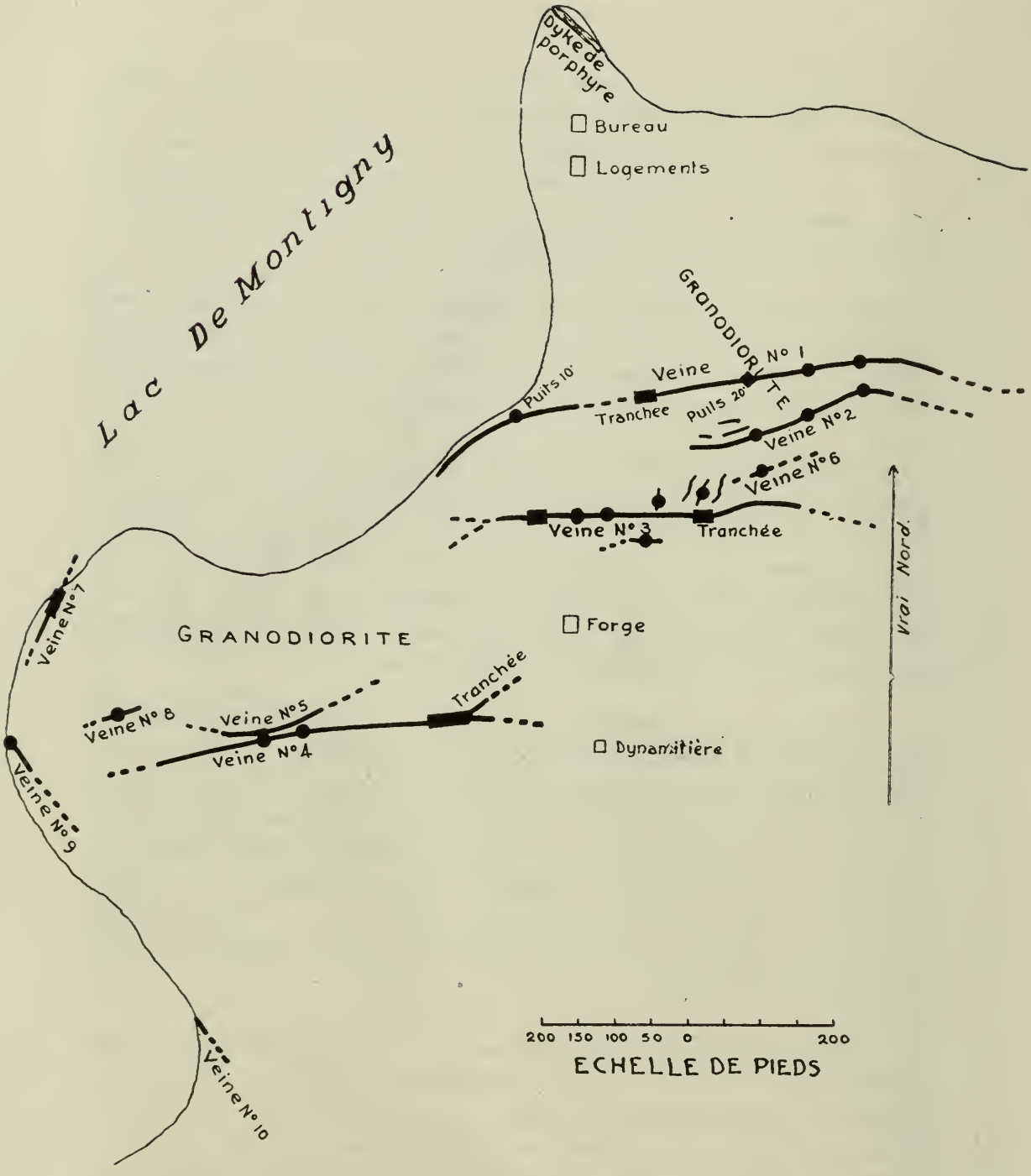

Fig. 3.—Sullivan claims, Dubuisson Tp.—Plan of vein outcrops.

Prospecting on this claim revealed ten different veins, five of which were main veins and five were outcrops of lesser importance.

Vein No. 1, the first discovered, was followed at the surface by trenching and excavations over a length of about 600 feet. It strikes in an approximately east to west direction in its southern portion as far as the lake shore and at that spot it strikes towards the south-west. Here five test-pits were sunk to the depth of 20, 10, 6, 4, and 3 feet respectively. The average width of the vein at the 20 feet shaft is 5 feet; elsewhere it varies between a few inches and two feet or over. The vein consists of quartz containing pyrite, a little chalcopyrite, galena and blende, with a little native gold. In some places the quartz is studded with black tourmaline crystals. An assay of an average sample from this vein, made at the provincial laboratory, gave a value of $7.00 of gold to the ton.

Vein No. 2.—About parallel to vein No. 1 with N. 70° E. strike, is situated about 60 feet to the south of the latter. Three excavations from 4 to 6 feet in depth have been made. The width of the vein varies between a few inches and two feet. It contains an abundance of tourmaline and sometimes this ore forms compact lumps or dykelets solely with this mineral. The vein has been followed on the surface over a length of about 300 feet, by means of trenches.

Between vein No. 2 and vein No. 3 there are isolated lenses of tourmalinized quartz, alignment is transversal to the general direction of the veins.

Vein No. 3 is about 75 feet south of vein No. 2. Its strike is practically east to west. It has been followed on the surface over a length of about 300 feet by means of superficial cuttings. In its eastern part it is merely a thin dykelet, a couple of inches wide, filled with quartz and tourmaline. It widens gradually as it runs towards the west where it attains a width of 2 feet 6 inches at the top of a steep rock facing the lake at a distance of 200 feet from the latter. As it enters this rock, the vein forks into two narrow veinlets with enlargements in the shape of lenses. Tourmaline abounds in these veinlets, and particles of native gold are often

found in it. The granodiorite of the walls is crossed by numerous quartz veinlets with a fracture from one to two inches wide, and, in the vicinity of the vein, the granodiorite is studded with pyrite cubes the sides of some of which are two inches. The dip of this vein is practically vertical at its widest part, where it measures 2 feet 6 inches; elsewhere it has various dips, sometimes to the north, sometimes to the south. At the forks, the rock dips under the loose soil and no efforts have been made to find the prolongation of the vein.

Vein No. 4 is situated about 300 feet to the south of vein No. 3. Its general strike is N. 75° W. and it dips at an angle of 70 degrees towards the south. At its eastern end it forks into two veinlets. It has been uncovered at the surface over a length of about 500 feet by means of trenches and excavations. At the first excavation at the eastern extremity, which is six feet deep, the vein is two feet wide and the walls are brecciated. The granodiorite on the walls contains large pyrite cubes, the sides of some of which are four inches wide. One of these cubes, assayed at the provincial laboratory, gave $3.00 of gold to the ton. One of these cubes is cut by a tourmaline veinlet. Towards the west, the width of the vein varies between 6 and 12 inches. Tourmaline is also very abundant in the rock and in the quartz vein. The brecciation proves that tourmalinization took place after the rock was crushed since the tourmaline surrounds the angular pieces of granodiorite.

Vein No. 5 outcrops a few feet to the north of vein No. 4. No work has been done on this vein with the exception of the trenches for uncovering it.

There are other outcrops on the lake shore to the east of veins Nos. 4 and 5. These outcrops are indicated on the plan accompanying this report by the numbers 7, 8, and 9. Outcrops No. 6 is situate between veins Nos. 2 and 3.

Claims of the Martin Gold Mining Company, Limited.—This company which owns a part of lots A and 37, ranges VIII and IX of Dubuisson township has a shaft 125 feet deep, with cross-cuts and drifts 100 feet long, in a vein of gold-bearing quartz, explored on the surface over a length of 700 feet. The vein cuts the green rocks and basalts of ellipsoidal structure of the Abitibi group.

The Martin Gold Mining Co.,—Gold bearing vein, on block A range IX, Township of Dubuisson, Abitibi, Que.

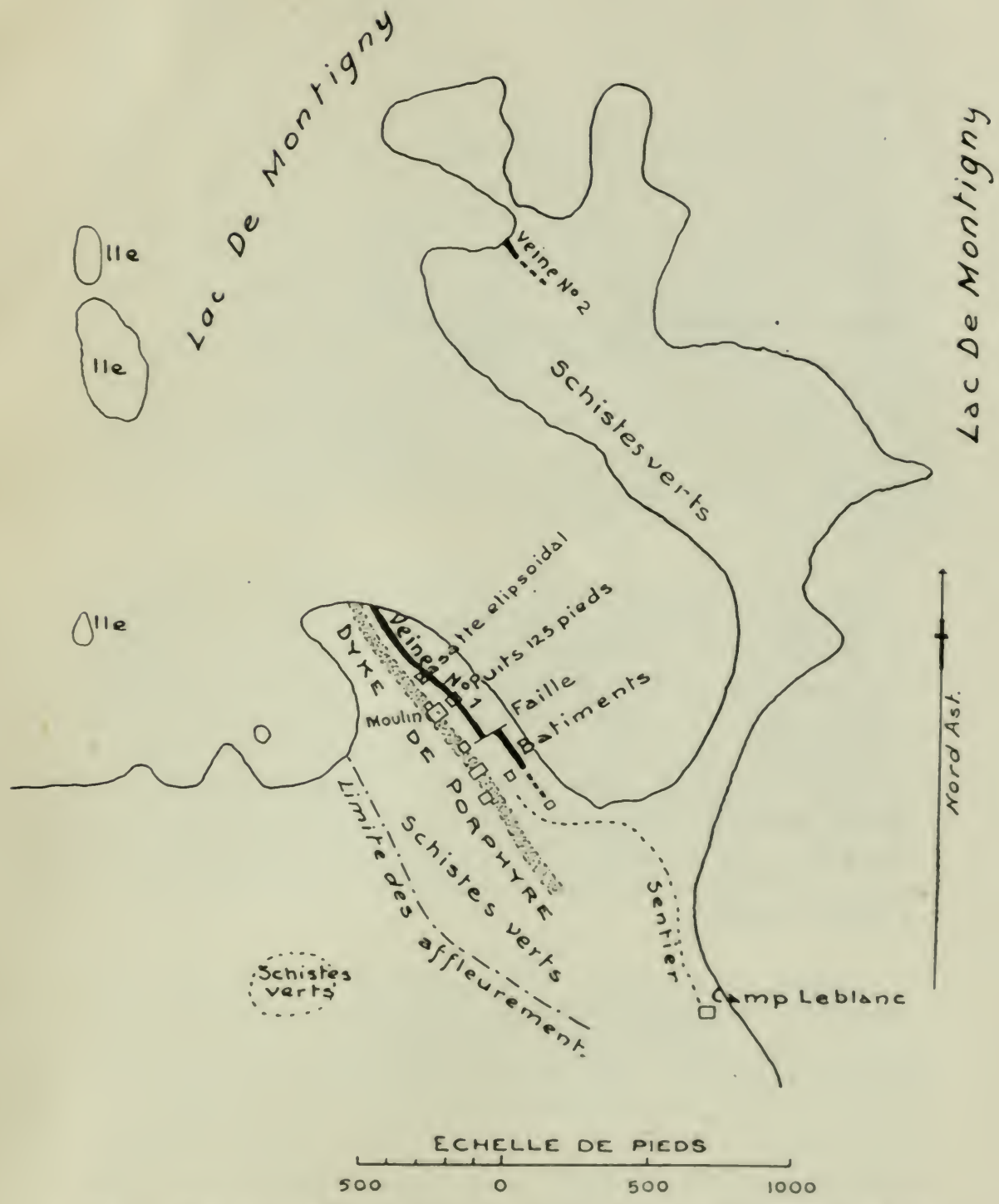

Fig. 4.—Martin Gold Mine Co. Ltd.—Plan of vein outcrops, prospecting work, buildings and shaft.

The intrusion of a dyke of felspathic porphyry also cuts the rocks of the Abitibi group and runs in a direction about parallel to that of the vein. This intrusion is 50 feet wide at the locality of the outcrop 30 feet to the west of the vein on the lake shore. The general strike of the vein is S. 45o E. and its dip is about 70 degrees towards the northeast. The vein has been uncovered over a length of 700 feet by means of excavations and trenches and its width varies between 2 and 11 feet. It is formed of blueish quartz containing inclusions of greenstone. The inclosing rock and the quartz are mineralized; the latter contains visible gold. The sinking of the shaft on the vein has been begun and it has been deepened vertically to depth of 125 feet. The walls of the vein dip away from the shaft at a depth of about 35 feet. A cross-cut, 10 feet wide has been made at the bottom of the shaft to cut the vein in depth, and drifts have been driven on it, one 50 feet in a northerly and the other 25 feet in a southerly direction. The vein in the drift is 11 feet wide.

In 1918, the company, for experimental purposes put up a small mill near the shaft. The ore is hoisted in a box containing about 600 pounds of rock and dumped into a small ore car running on a trestle between the mine and the mill. The ore is run through a jaw-crusher from which it falls into a bin with a capacity of 25 tons, feeding a ten-stamp battery. The pulp afterwards passes on three amalgamating plates measuring 4 by 6 feet. This mill worked during the summer of 1918, but the gold extracted was not disposed of. It is claimed that the ore gives a good yield. Development work on the mine was suspended in July last, owing to financial difficulties.

Claims of the Siscoe Mining Syndicate.—This mine, now worked by the British Minerals Corporation, Limited, is situate on the largest island in lake DeMontigny and the property covers an area of 360 acres. The island is formed of more or less altered igneous rocks belonging to the Abitibi group. The northern part of the island is composed of granular diorite, porphyritic diorites and andesites; the remainder of the island consists of greenstones and ellipsoidal basalts. All these rocks are cut, here and there, by irregular dykes of quartz porphyry. The gold is found in veins and stringers of quartz in which there is a good deal of tour-

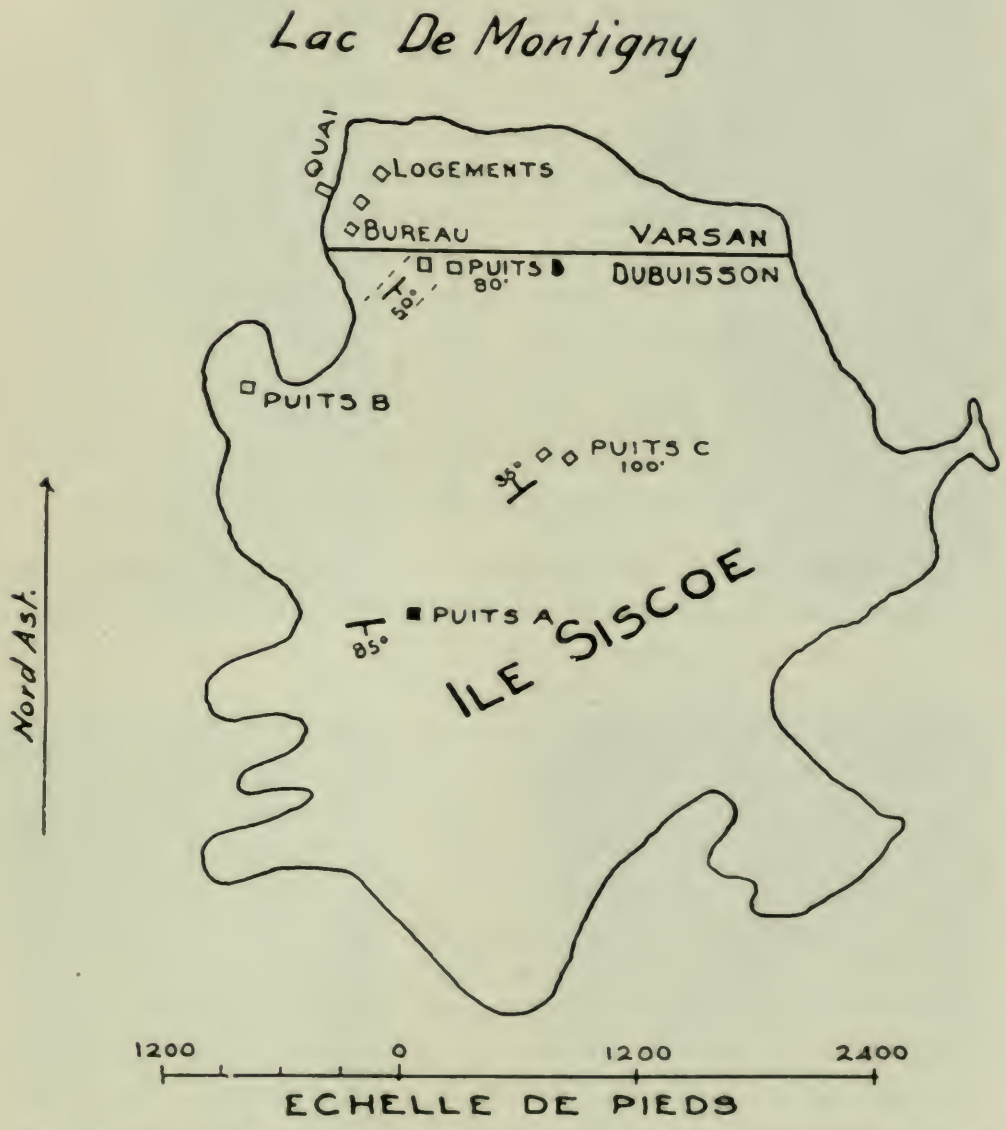

Fig. 5.—Siscoe Claims.—Plan of Siscoe island showing prospecting shafts A, B, C and D.

maline, a little calcite and an abundance of iron pyrites. In one of the veins (vein "C") grains or small masses of scheelite are sometimes found.

Prospecting has been done on the four principal veins: "A", "B", "C", and "D". A 45 foot shaft has been sunk on vein "A"; this vein dips vertically to that depth. The vein has been uncovered on the surface over a length of 90 feet. The shaft of vein "B" is 32 feet deep, where it comes in contact with a dyke of quartz porphyry from 8 to 10 feet wide and cutting the greenstones of the Abitibi group. On vein "C" a shaft has been sunk to a depth of 100 feet, inclined at an angle of 35 degrees, following the dip of the vein. The vein is 22 inches wide at the bottom of the shaft. Dr. J. A. Bancroft, who made a report on this property in 1919 for the British Minerals Corporation, Limited, took four samples across the vein at depths of 41 and 47 feet and obtained assays of 80c., $8.00, $21.00, and $33.00 of gold to the ton. He considers this vein as the best that has been discovered on the property.

The zone of vein "D" comprises a number of scattered veins and quartz lenses seldom over a few feet or yards in length. These veins cut the greenstones of the Abitibi Group which have the composition of andesite and fine grained diorite. In some places, irregular dykes of pale green quartz porphyry, a few feet wide, cut the greenstone. Several of the quartz veins contain nests or pockets rich in native gold, in which wonderful specimens are sometimes found. Mr. John A. Dresser and Professor J. W. Bell, of McGill University made a thorough sampling of this zone. One sample, weighing 8.3 tons, crushed in the stamp-mill and passed through the amalgamator yielded $34.64 of gold to the ton. This sample consisted chiefly of pure quartz in which particles of native gold were sometimes observed. In their opinion the prospective value as indicated above, is sufficient to warrant undertaking further development work, especially taking into consideration the fact that the network of stringers in D zone and the C vein itself dip towards each other, the possibility of their being related is a matter which merits exploration. This work should be concentrated on the area between C and D, on the D zone. It would be most economically done in the first instance by diamond drilling, say to the amount of three or four thousand feet."

Siscoe Island gold mine, Lake De Montigny, Dubuisson, Abitibi, Que.—"A" Shaft.

Siscoe Island gold mine, Lake De Montigny, Dubuisson, Abitibi, Que. "D" Shaft.

Siscoe Island gold mine, Lake De Montigny, Dubuisson, Abitibi, Que.—"G" Shaft.

Martin Gold Mining Co. Shafthouse and Mill Building, block A, range IX, Dubuisson.

J. F. Stabell's Claims.—These claims occupy the north half of lots 53, 54, 55 and 56, range VIII Dubuisson township. A vein has been found on lot 53, varying between 2 and 30 feet in width, crossing the claim with a N. 40° W strike and a dip 70 degrees towards the north on a length of 900 feet. This vein is formed of dykelets of quartz interstratified in the greenstone schist of the Abitibi group. On the surface, the vein is covered with a thick layer of rust due to the decomposition of iron pyrites abundantly scattered in the quartz and in the schists of the walls. This vein extends to the east on J. B. Legault's claim. Towards the eastern end of the vein there is a porphyry dyke cutting the green schists and with a strike almost parallel to that of the vein. The prospecting work has consisted in trenching and clearing the surface.

On lot 54, range VIII, near the dividing line between lots 53 and 54, a shaft was sunk to a depth of about 30 feet in the green schist with the object of cutting the vein below. This shaft was abandoned before its object was attained.

On lot 55 there is a vein about 6 inches wide with a north to south strike and vertical dip cutting the ellipsoidal basalts of the Abitibi group. A shaft 25 feet deep has been sunk on the vein which has been uncovered over a length of 200 feet. The width of this vein is about the same along its whole length. While all this work was being done, four buildings were put up to lodge the men and for repair shops. A portage road, about two miles long runs from these buildings to the south end of lake DeMontigny.

On lot 55 there is another veinlet of quartz about 150 feet to the north of the principal vein. Its strike is N. 80° W.; it cuts compact green schists. There are out crops of ellipsoidal basalts between the two veins. The width of the vein is about 8 inches on an average; its dip is 80 degrees towards the south. It has been uncovered on the surface by a trench for a distance of 150 feet.

It is situated 150 feet to the south of the line between ranges VIII and IX; it extends nearly to the line between lots 52 and 53.

On lots 52 and 53, range IX, there is a small vein of blueish quartz, 8 inches wide situated 100 feet to the north of the line between ranges VIII and IX. The vein has been uncovered

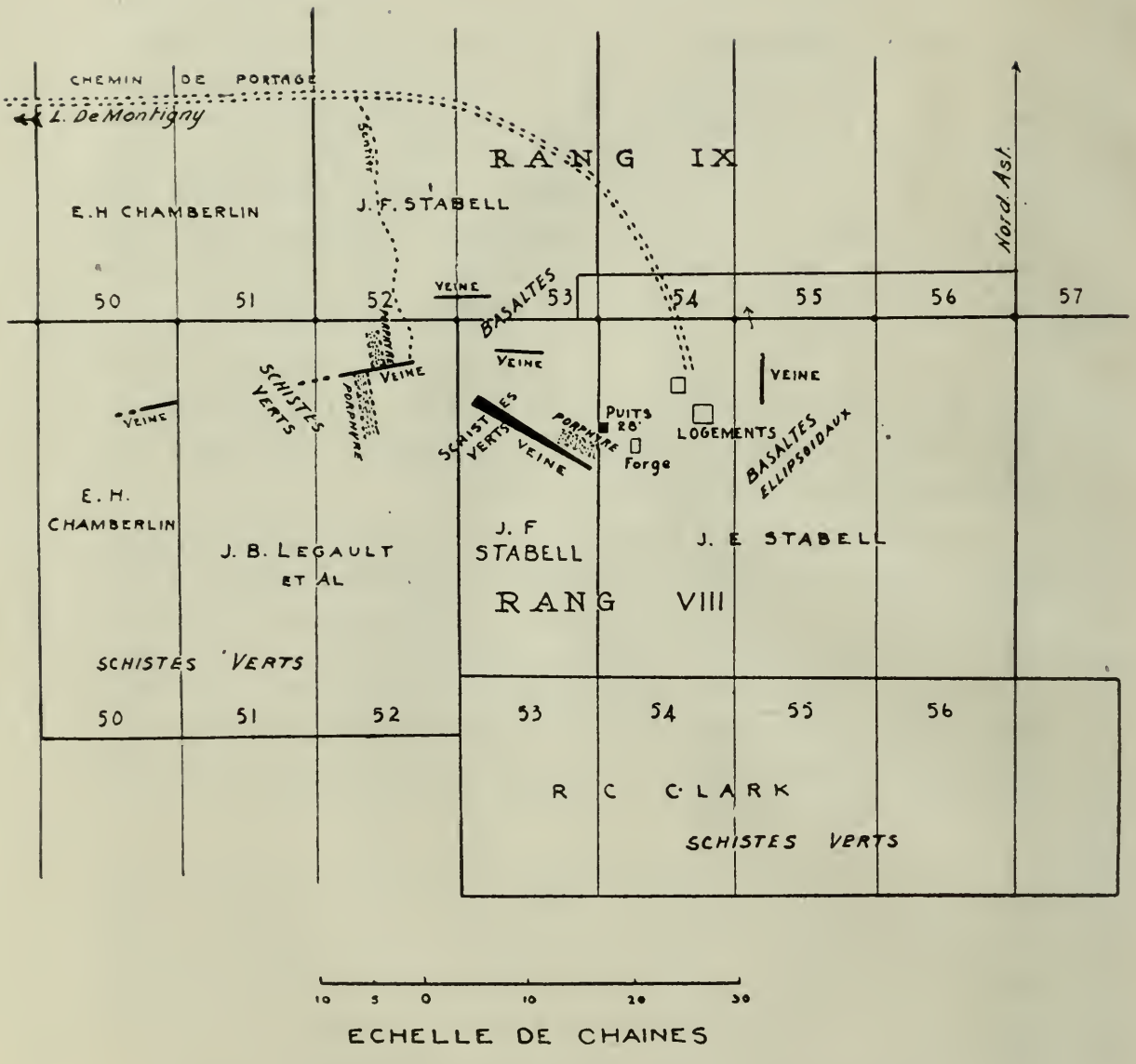

Fig. 6.—Stabell and Legault claims.—Plan of vein outcrops.

Craft property, lots 44 and 35, range VIII, township of Dubuisson, Abitibi, Que.—
Gold bearing vein.

Stabell porphyry, lot 53, range VIII, township of Dubuisson, Abitibi, Que.—
Quartz vein and porphyry dyke

over a length of about 100 feet. It cuts the green schists of the Abitibi group.

Foisie-Kengrow Claims.—These are situated between lake DeMontigny and the Thompson river on lots 27 and 28, ranges VII and VIII, Dubuisson township. These claims were staked in the month of June, 1919; while doing the assessment work required by law, the prospectors discovered a very encouraging gold-bearing vein. It outcrops near the corner post of lots 27 and 28 on the range line between ranges VII and VIII. Its strike is N. 45° W. and its average width is about 10 feet. The vein is formed of blue and white quartz containing pyrite, chalcopyrite, stibnite and particles of native gold. This vein cuts the green schists of the Abitibi group; there is an intrusion of quartz diabase at about 100 feet east of the outcropping of the vein. The vein has been uncovered on the surface by trenches and excavations over a length of about 150 feet. The upper part of the vein is covered with a thick coating of rust due to the decomposition of the pyrite, and good values are obtained by panning it

Saint-Germain-Gale Claim.—This is situated on the east shore of lake Lemoine, about a mile south of lake DeMontigny and occupies lots 38, 39, 40, 41, 42 and 43, range VII, Dubuisson township. The land is generally low-lying but with some irregularities. The whole ground, with the exception of a few rocky knolls, is covered with drift.

A good deal of prospecting work has been done by means of surface trenches and rock excavations and three principal veins were discovered in which shafts have been sunk to a slight depth.

The rocks consist chiefly of ellipsoidal andesite cut by two dykes of dioritic porphyry. The dykes are formed of crystals of plagioclase feldspar in a black matrix containing microlites of hornblende, plagioclase feldspar and a little quartz. The strike of these dykes in the north part of the claim is N. 70° W. and that of the other, about 300 feet further to the south, is N. 53° W.

The principal vein (vein No. 1) is formed of lenses of quartz elongated along the contact of the north dyke of dioritic porphyry. The width of the vein varies between 1 and 6 inches.

It has been uncovered on the surface over a length of about 200 feet and an excavation of about 6 feet has been made. Native gold in filaments or in clumps of fine particles are frequently found in it.

Twenty-five feet further to the south, is another vein (vein No. 2) cutting the ellipsoidal andesite, in which a shaft 18 feet deep has been sunk. The shaft was full of water at the date of our visit, but the vein is said to be three feet wide at the bottom of the shaft. On the dump, from the sinking of the shaft, an abundance of calcite is found associated with the quartz. Pyrite is also present, but not in great quantity.

Still further to the south, about 200 feet, is another vein (vein No. 3) at the second diorite porphyry dyke. The walls of the vein are much decomposed and very friable. A shaft about 12 feet deep has been sunk on it. Pyrite is in greater abundance here than in the other veins.

Neveu Claim.—This claim, which covers an area of 135 acres, was staked for the first time in 1912 by Mr. S. G. Smith, in the name of Mr. N. L. Tooker. Since then it has been staked several times and it was recorded in Mr. Geo. Neveu's name in 1919. This claim comprises the northern part of lots 44 and 45, range VIII, Dubuisson township. It is situated about a third of a mile to the south of the first bay of lake DeMontigny, east of the outlet of lake Lemoine. The vein outcrops on the slope and summit of a rocky knoll. The enclosing rock, green schist of the Abitibi group, is cut by a dyke of feldspathic porphyry similar to that along the Martin vein. The width of the dyke is 35 feet and its strike is N. 40° W. The strike of the vein is N. 60° W. and it has a dip of 35 to 55 degrees south. It is formed of a series of lenses of quartz from 6 to 15 inches wide. With the exception of the spots where it is rusted by the decomposition of sulphides of iron and copper, the quartz in the vein is milk-white and sometimes has a granulated appearance. Pyrite grains are largely disseminated in the quartz as well as a little chalcopyrite, some specks of native gold, slender crystals of black tourmaline and a very small quantity of calcite and epidote. Over a length of 35 feet

to the east of the witness post, erected 45 feet from the porphyry dyke, the vein is much more mineralized than elsewhere.

In the quartz are small tourmaline crystals, either isolated or in radiating aggregates and we also observed some in the enclosing rock, one foot from the walls of the vein. In the vein itself there are often tourmaline crystals and epidote crystals filling thin veinlets in the quartz; the latter are probably secondary fissures formed in the quartz after it became solid and in the last stages of the formation of the vein.

Marsil Claim.—This claim comprises lots 39 and 40 of range V, Varsan township. The principal vein of this claim outcrops on the east shore of lake DeMontigny about two miles from its outlet in the Askigwaj river in a small bay opposite Siscoe island.

This vein was discovered for the first time in 1912 when it was staked by Mr. Benard. It has been restaked by several persons since then, and in 1919 it was recorded in the name of Mr. Tancrède Marsil of Montreal.

This vein is formed of a succession of parallel quartz stringers intercalated between bands of syenite composed of albite feldspar and grains of iron pyrites. The quartz stringers vary between a few inches and two feet in width; in the syenite bands are generally numerous isolated needle-shaped crystals of black tourmaline; the latter also sometimes forms bunches of needles occupying the whole middle of the vein. A sample of syenite containing iron pyrites grains, assayed at the provincial laboratory, gave $4.60 gold to the ton. In 1912, Dr. Bancroft had a sample of the same rock assayed and it gave $1.40 of gold to the ton.

So far, practically no work has been done on this claim with the exception of a shallow excavation on the lake shore and a trench across the vein.

Craft's Claim.—This claim occupies the southern parts of lots 44 and 45, range VIII, Dubuisson township. The rocks are Abitibi volcanics, cut by a dyke of feldspathic porphyry which is cut in its turn by a quartz vein in the shape of an elongated lens. A shaft has been sunk in its wider part (11 feet) to a depth of 6

feet. The vein narrows towards the east and west. Its strike is N. 35° W. It is about 3 feet wide at 50 feet east of the shaft; here the vein forks into two stringers one of which continues in the direction of the main vein while the other takes an approximate east-to-west direction; the latter has an average width of 6 inches and has been uncovered on the surface over a length of 50 feet. The total length of the trenches on the property is about 200 feet. An assay of a sample, taken across the vein at the bottom of the 6 foot shaft, gave $3.60 of gold to the ton.

Immediately to the south of the vein, is a rocky outcrop, about 500 feet in diameter formed of intrusions of diabase and porphyry, the latter being more recent than the diabase. There are also patches of green schists belonging to the Abitibi group.

Parker Claim.—This claim comprises an area in lake DeMontigny, in which are two islands, situated near the west shore of the lake in range IX, Dubuisson township. A vein of auriferous quartz has been discovered on the southern island. This vein has been cleared on the surface over a length of about 150 feet and some small excavations have been made in the rock. The general strike of the vein is not well defined but is generally east to west. At the eastern end, it is cut by a fault with a throw to the south over a distance of 40 feet. The superficial part of the vein is much decomposed and very rusty. The quartz in the vein contains an abundance of iron pyrites, a little chalcopyrite, blende and galena. Panning the rusty part always gives good values.

To the south of the vein, at a distance of about 100 feet, is an outcropping of fine-grained porphyry in the shape of parallel dykes cutting the green schists of the Abitibi group and with about the same strike as the vein.

Legault Claim.—This claim forms the north part of lots 51 and 52, range VIII, Dubuisson township.

The principal vein, with a strike N. 75o E., is about 175 feet south of the concession line between ranges VIII and IX. The average width of the vein is 4 feet; it has been uncovered by a superficial trench over a length of 200 feet. It is formed of quartz

containing inclusions of very chloritic green schists in which there is iron pyrites finely disseminated, and it also contains clumps of tourmaline. This vein cuts the green schists of the Abitibi group; near the vein there is also a dyke of feldspathic porphyry which likewise cuts the green schists and is cut by the vein. The strike of this dyke is N. 30° W. and its width about 10 feet.

An excavation 5 feet deep has been made in the rock of the principal vein. The dip of the vein is about 70 degrees south.

Surface trench work to find other veins has also been done on this claim; these trenches are transversal to the main vein and have been dug to the south of it. This work has brought to light some stringers of rusty quartz two inches wide at the most.

Clowse Claim.—This claim comprises a portion of lots 46 and 47, range VI, Dubuisson township. To reach this claim, one has to follow a path along the line between ranges VI and VII, starting from lake Lemoine. Along this path rocky outcrops are found on lots 44 and 45; these are schists and conglomerates belonging to the Pontiac series. On the Clowse claim, the outcrops are chiefly formed of green schists and ellipsoidal basalts on the north side, while on the south, we find the Pontiac series. The vein on the claim is situated near the line between ranges VI and VII; its strike is N. 30° W. Its width is about 6 inches. It has been uncovered on the surface over a length of 100 feet and a shaft 27 feet deep has been sunk on it. The vein cuts the green schists of the Abitibi group.

Mannibal Claim.—This claim occupies the whole of lot 35, range VIII Dubuisson township. The vein discovered on it strikes N. 50° W. with a slight dip to the southwest. At the surface it is 6 inches wide and 10 inches at the bottom of an excavation, 6 feet deep. There is another small vein, 4 inches wide about 50 feet south of the first one and parallel to it. The filling of the vein consists of quartz containing a little iron pyrites and tourmaline.

Other Claims in the region.—There are some other claims on which very little prospecting work has been done. Most of them contain outcrops of quartz veins containing iron pyrites. All

these veins cut the green schists of the Abitibi group. Among the most interesting of the latter, we may mention the Carrière claim occupying lots 40, 41, and 42, range IX, Dubuisson township, on which a couple of narrow quartz veins have been discovered on the shore of lake DeMontigny, which dip under a thick layer of stratified clay. The Sicard claim may also be mentioned which comprises a part of lots 40, 41 and 42 range VIII, Dubuisson township. Surface trenches have been dug along a total length of 300 feet and a vein about one foot wide has been found which cuts the green schists of the Abitibi group. We also noted the presence of a dyke of quartz porphyry, cutting the green schists.

Another claim deserving mention is the Caron claim, which comprises an area in lake DeMontigny, north of the property of the Martin Gold Mining Company Limited, in which are a couple of small islands. On these islands narrow quartz veins, containing a little pyrite, have been found. On the island further to the west, there is an intrusion of quartz porphyry cutting the green schists of the Abitibi group.

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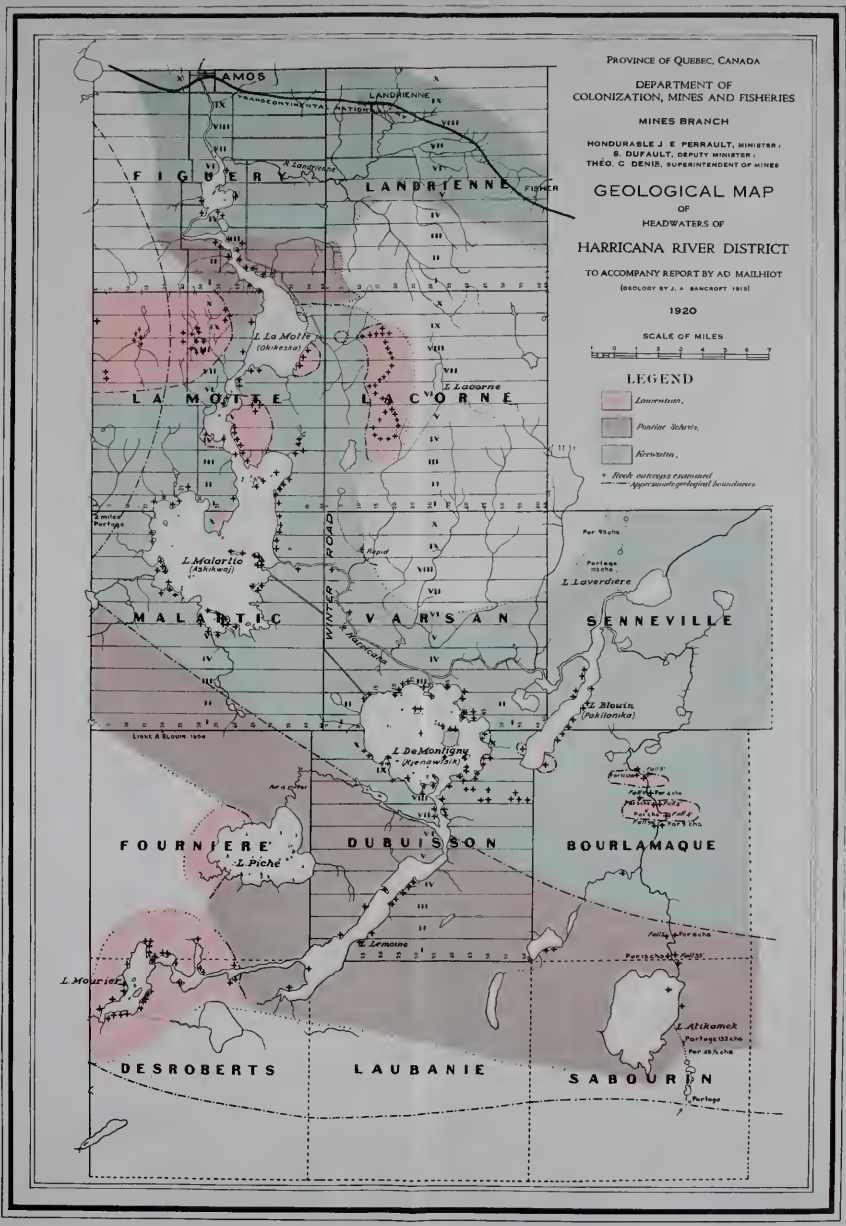
PROVINCE OF QUEBEC, CANADA
DEPARTMENT OF COLONIZATION, MINES AND FISHERIES
MINES BRANCH
HONOURABLE J. E. PERRAULT, MINISTER;
S. DUFAULT, DEPUTY MINISTER;
THÉO. C. DENIS, SUPERINTENDENT OF MINES
GEOLOGICAL MAP
OF
HEADWATERS OF
HARRICANA RIVER DISTRICT
TO ACCOMPANY REPORT BY AD. MAILHIOT
(GEOLOGY BY J. A. BANCROFT 1913)
1920
SCALE OF MILES
LEGEND
Laurentian.
Pontiac Schists.
Keewatin.
Rock outcrops examined
Approximate geological boundaries
AMOS
LANDRIENNE
TRANSCONTINENTAL RAILWAY
FIGUERY
LANDRIENNE
FISHER
L. La Motte (Okikesta)
L. Lacorne
LA MOTTE
LACORNE
L. Malortie (Akikwoj)
WINTER ROAD
Harricana
MALARTIC
VARSAN
SENNEVILLE
L. Laverdière
L. Blouin (Pakilanika)
L. DeMontigny (Kenawbik)
FOURNIÈRE
DUBUISSON
BOURLAMAQUE
L. Piché
L. Lemoine
L. Mouriel
L. Atikomek
DESROBERTS
LAUBANIE
SABOURIN